CHARLES UNIVERSITY IN PRAGUE

FACULTY OF PHYSICAL EDUCATION AND SPORT

DEPARTMENT OF PHYSIOTHERAPY

Physiotherapy Treatment of a Patient in sub-acute phase after Ischemic Cerebrovascular Accident (Ischemic Stroke)

BACHELOR THESIS

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ABSTRACT

Title of the thesis: Physiotherapy treatment of a patient in sub-acute phase after Ischemic Cerebrovascular Accident (Ischemic Stroke).

Název práce: Fyzioterapie léčba pacienta v subakutní fázi po ischemické cévní mozková příhoda (mozková mrtvice).

Author: Minas Kouroglou

Work placement: Oblastni Nemocnice Kladno

Summary

The objective of this thesis is to spotlight the physiotherapeutic approach and procedures applied for a patient in sub-acute phase after the diagnosis of Acute Ischemic Cerebrovascular Accident (Ischemic stroke) and also meticulously demonstrate the examination and therapy process provided in an actual case study of the diagnosis.

The thesis is divided into two parts. The General part which is the opening part of this thesis is trying to explore the basic theoretical components related to the diagnosis and its characteristics while also reviewing the anatomy, physiology and neurophysiology of the brain structures involved in this specific case study, which is extensively presented in the second, specific part of this paper

The specific part of this thesis includes: Anamnesis and Medical History of the patient, Initial and Final kinesiological examinations of the patient with their respective conclusions, a detailed review of the whole therapeutic procedure including the rehabilitation plan, the goals of the therapy, the implementation of the therapeutic sessions in a day by day manner and last by not least the evaluation of the therapeutic procedure and its results.

Keywords: Case Study, Ischemic Cerebrovascular Accident, CVA, Ischemic Stroke, Hemi-Paresis, Apraxia, Neglect syndrome Physiotherapy, Rehabilitation, Physiotherapy in Neurological Conditions.

DECLARATION

I sincerely declare that this bachelor‘s thesis was exclusively managed and fulfilled by myself, under the supervision and instructions of Mgr. Helena Vomáčková. All information and clinical procedures which are presented in this thesis was based on used bibliography and knowledge gained during my academic studies. My thesis is an original work and demonstration of my clinical work that was performed under the supervision of Bc. Tomáš Modlinger at Oblastni Kladno Nemocnice in Kladno, Czech Republic under the auspices of The Faculty of Physical Education and Sports of Charles University in Prague.

Minas Kouroglou

Prague, 2016

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DEDICATION

I would like to dedicate this Thesis to myself for always being me and for not giving up even at the lowest moments of my long, stressful but rewarding and life changing academic life in Prague.

Also I would like to dedicate this thesis to my best friends, Andreas, Maria, Ermis, Christos and Marina with whom I go almost 20 years back. I would like to thank them for everything we have been through and for the unconditional love they all gave me through the years.

I would like to dedicate this thesis to my loving girlfriend Eleni and thank her for giving me her enormous support and love and for sharing some of the best moments in my life with her.

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Last and most importantly I am dedicating this thesis and my whole life's work to my Mother Margarita and to my Father Ioannis and I want to take advantage of this section to thank them for truly being the best parents in the world. Without them I would not have been here achieving what have achieved and I would not be the person I like to think I am. I want to thank my loving mother for bringing me to this life and teaching me that absolute unconditional love really exists while being the most supporting person in the world for me, and my loving Father for always being there for me, for disseminating his artistic interests to me and for teaching me that Spirit is more important than matter.

Table of Contents

1. Introduction

The objective of this thesis is to spotlight the physiotherapeutic approach and procedures applied for a patient in sub-acute phase after the diagnosis of Acute Ischemic Cerebrovascular Accident (Ischemic stroke) and also meticulously demonstrate the examination and therapy process provided in an actual case study of the diagnosis.

The thesis is divided into two parts. The General part which is the opening part of this thesis is trying to explore the basic theoretical components related to the diagnosis and its characteristics while also reviewing the anatomy, physiology and neurophysiology of the brain structures involved in this specific case study, which is extensively presented in the second, specific part of this paper. The frontal and parietal lobes of the brain are concretely discussed in the general part since according the medical documentation and diagnostic tools were the structures of the brain affected by the ischemia that caused the CVA, suffered by the patient that was the subject of the case study presented in this thesis. The Middle Cerebral Artery is also emphasized for being the artery where the ischemic accident originated. The general part will also include a biomechanical review related to the clinical manifestation of the diagnosis and it will conclude by highlighting the therapeutic procedures that are clinically used for patients that suffered from an Ischemic CVA with the emphasis being on the Physiotherapeutic approaches.

The second and most significant part of this thesis is the actual case study of a patient with whom I had seven physiotherapeutic sessions over the period of ten days in Oblastni Nemocnice Kladno where I had my clinical practice that took place from 18-1-2016 until 29-1-2016. The specific part of this thesis includes: Anamnesis and Medical History of the patient, Initial and Final kinesiological examinations of the patient with their respective conclusions, a detailed review of the whole therapeutic procedure including the rehabilitation plan, the goals of the therapy, the implementation of the therapeutic sessions in a day by day manner and last by not least the evaluation of the therapeutic procedure and its results.

2. General Part

2.1 Physiology Anatomy and Functions of The Frontal Lobe of the Brain.

The frontal lobe of the cerebral cortex is the anterior portion of each one of the two cerebral Hemispheres. The frontal lobe is separated from the parietal lobe by a fissure which is called central sulcus, the precentral gyrus which is involved in the motor control is part of the frontal lobe located anterior of the central sulcus. The frontal lobe consists of the prefrontal cortex, the premotor cortex, and the motor cortex along with the supplementary motor area. The frontal lobe is associated with functions such as the Voluntary motor control of the skeletal muscles, the higher intellectual processes such as the concentration, planning and decision making as well as the personality with the extend to the social behavior and also the verbal communication [6, 7 ,9 ,15].

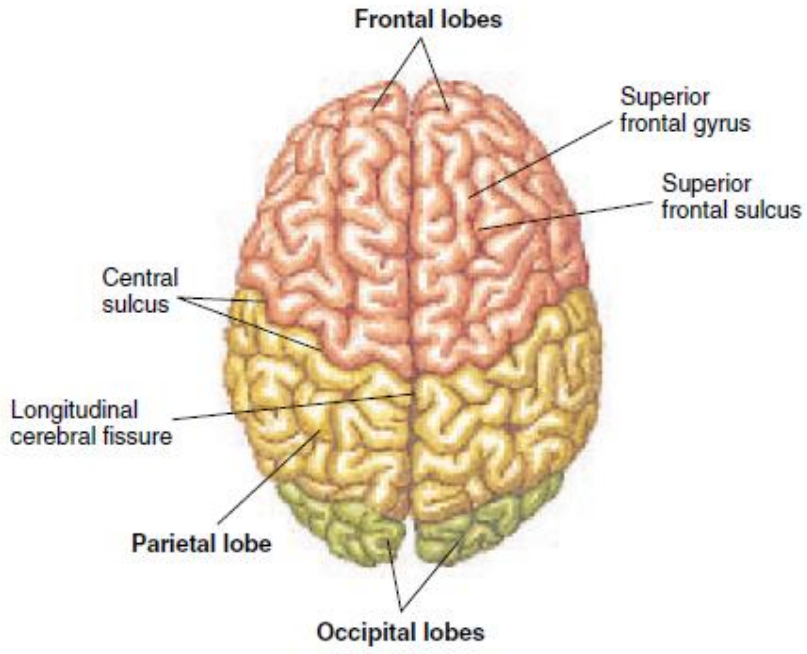


Figure 1- The Human Brain including the cerebral cortex and the Frontal and Parietal Lobes.

2.1.1 The Prefrontal Cortex

The prefrontal cortex covers the anterior part of the frontal lobe and is associated with cognitive behavior, personality and excitation or inhibition of emotional response and also in synergy with other parts of the brain assists in the management of important neurotransmitters like dopamine, norepinephrine and serotonin which are involved mood, cognition, control of locomotion and endocrine functions. [6, 7 , 15]

2.1.2 The Motor Cortex

The motor cortex consists of the primary motor cortex, the premotor cortex and the supplementary motor area with all of the above located in the Frontal lobe. The motor cortex is the area of the cerebral cortex associated with voluntary motor control along with the planning and the execution of a voluntary motor response. The main neural impulses that are descending to the spinal cord facilitating a movement are primarily generated in the primary motor cortex which functions along with other brain structures outside the cerebral cortex like the basal ganglia where the upper motor neurons which have a major role in muscle regulation are passing through to facilitate, plan, sequence and execute a motor movement. Important aspects and factors involved in the voluntary motor control such as guidance of a movement and the guidance of reaching to an object are also regulated by the pre-motor cortex which is located anterior to the primary motor cortex in the cerebral cortex region covering the frontal lobe. The Supplementary motor area is involved in movement planning and coordinating the two sides of the body to execute a movement. A Damage to the frontal lobe of the brain can generate different disabilities according the part which is affected and in extension the respective function which represents, such as speech (aphasia in case of affection of Broca's Area and is responsible for language processing, speaking, and control of facial neurons), cognition (lack of the ability to plan or make a decision such abulia) and motor functions (impaired motor control, lack of fine motor control) [6 ,7].

2.1.3 Physiology, Anatomy and Functions of the Parietal Lobe of the Brain

The parietal lobe of the brain is separated by the central sulcus from the frontal lobe as mentioned above and it is located posterior to the frontal lobe. The postcentral gyrus which is a convolution of the parietal lobe and is located behind the deep depressed central sulcus is the area of the cerebral cortex, which is primarily responsible for the somatesthetic sensation that includes the sensation received from cutaneous sensation, muscular sensation, tendon receptors and joint receptors. The parietal lobe is also involved in understanding of the speech and the ability to formulate words to express thoughts and emotions while also it has proven to be really important in the ability of a person to interpret shapes and textures. The somatesthetic sensation includes the deep sensation system incorporates two point discrimination, kinesthesia,

graphesthesia and touch localization, functions that could be impaired in case of damage of parietal lobe. Conditions such as neglect syndrome and apraxia can result after damage of the parietal lobe as well [6, 7, 15]

2.2 Blood supply of the brain

The human brain receives its arterial supply from two major pairs of vessels which are the vertebral and the internal carotid arteries producing the cerebral arterial circle of willis. The two vertebral arteries are coming through the foramen magnum in order to enter the cranial cavity inferiorly of the pons and forming the basilar artery while the two internal carotid arteries are entering the cranial cavity through the carotid canals on either side.

The cerebral arterial circle (of willis) takes its form at the base of the brain where the basilar and internal carotid system of vessels are interconnecting with each other. This system is completed by one anterior communicating artery which connects the 2 cerebral arteries with each other and two posterior communicating arteries which are respectively connecting the internal carotid artery with the posterior cerebral artery. [6 , 7]

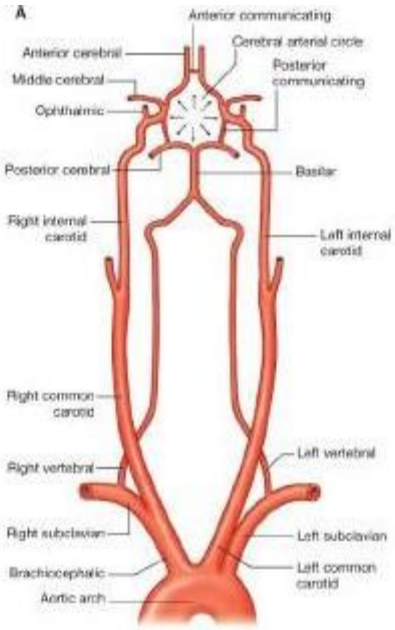


Figure 2- Components of the Brain Blood Supply System.

2.2.1 The Middle Cerebral Artery (MCA)

The middle cerebral artery is the most major and by far the largest artery of the three major cerebral arteries entering blood to the human brain and is a brunch of the internal carotid artery. The middle cerebral artery supplies with blood the lateral areas of the Frontal, Parietal, and Temporal Lobes of the cerebral cortex. It is also the most commonly affected artery by a Cerebrovascular Accident. There is a list of neurological deficits that can occur after a CVA originated in the MCA and are clinically manifested according the structures involved. For example (and according the actual case study presented in the specific part of this thesis) if the bilateral frontal lobe is affected after ischemia of MCA that could result in apraxia of gait or if the non-dominant side parietal lobe is affected it could result in unilateral neglect, unawareness of hemiplegic side [6, 17, 18]

2.3 Biomechanical Review after Cerebrovascular Accident

In order to properly review the biomechanics of CVA we should mention that there is a really wide spectrum of findings and biomechanical changes that are varying from case to case since the deficits after a CVA are really specific for each individual. This biomechanical review will attempt to highlight the biomechanical changes resulting in a hemi-paretic gait while keeping in mind the idiosyncrasy of the case study presented in the specific part of the thesis.

We can distinguish stroke biomechanics in negative motor signs and positive motor signs with the former (negative) concerning absence of important factors contributing to a physiological gait such as muscle tone, dexterity and voluntary motor control and the latter (positive) concerning the appearance of pathological signs such as clonus and spasticity.

As far as gait goes a physiological walking pattern is an automatic process which required the absolute contribution and integration of various mechanisms. After a brain damaged caused by a Cerobrovascular Accident most of those automatic mechanisms are absent with the patient trying to compensate by including voluntary effort. Below I am trying to review each of the components of a hemi paretic gait and their biomechanical attitude after a CVA. [13, 16 , 17 , 21].

Ankle Joint

As far as early stance goes (heel strike to foot flat) in a hemi paretic gait the anticipation of the weight bearing is exciting the extensor synergy resulting in plantar flexion instead of dorsal flexion and in extend the eccentric contraction of the dorsal flexors of the food that prevents the slapping of the foot in a physiological gait is absent. The whole sole of the foot is makes contact with the floor at the same time thus the heel strike is absent. In some cases there is pronounced inversion of the foot which results in the contact of the lateral side of the foot with the floor as well. As far as mid stance goes in hemi-paretic gait if the triceps surae appears hypotonic, it could create a dropped foot phenomenon with absent dorsal flexion and the finding that during the gait the patient seems to "drag" his affected foot in order to move forward. As a result the knee can lack of flexion because of the lack of dorsiflexion affecting the late stance phase (unloading to push up) of the gait. Due to the lack of this push of effect the force which is required to initiate, a proper swing is limited resulting in slow gait [16, 17, 21].

Knee Joint

Early and midstance phases could be absent if flaccidity is present in the lower extremity in opposition with a normal gait were while the heel strikes the knee is extended and starting to flex as the body weight shifts on the loading foot at 15 degrees of flexion under the influence of body's weight and it is controlled by eccentric contraction of the quadriceps muscles to prevent buckling. That is why in hemi-paretic gait there could be buckling the affected LE to the floor because that mechanism described above is likely to be absent. Also in a physiological gait the knee will flex along with plantar flexion of the foot in order to give momentum to the swing phase of the foot while this mechanism is likely to be absent in a hemi-paretic gait and the patient is possible to compensate to an alternative pathological mechanism in order to move forward.[16, 21].

Hip Joint

In a physiological gait pattern during the weight bearing of the lower extremity the abductors of the hip are preventing the hip by sagging on the opposite side along with the trunk flexors. In a hemi-paretic gait this mechanism could be absent and also the hip flexion could be absent because of the plantar flexion of the foot and the retraction of the pelvis. The absent rotation of the pelvis and the hip flexion could result in a phenomenon of the patient dragging his affected limb during gait with the affected side

of the pelvis being posterior the non-affected side and external rotation of the hip [16, 17, 21].

2.4 Cerebrovascular Accident (CVA/Stroke)

2.4.1 Characterization and Etiopathogenesis of the Disease

A Cerebrovascular accident or more commonly known as stroke is described as a sudden neurological deficit caused by a focal vascular lesion in the human brain. This vascular lesion could be either ischemic or haemoragic and involves the vessels supplying with blood various parts of the brain. The ischemic CVA is the most common type of cerebrovascular accidents consisting the 85 % of all CVA's while the haemoragic CVA consisting the remaining 15% of all CVA's and also having higher percentage of mortality in a comparison with the Ischemic CVA's. This thesis will emphasize on the Ischemic Cerebrovascular Accidents according the specific case study presented in its specific part. [7, 9, 11, 15 ,17]

2.4.2 Etiology of Ischemic CVA

The most common causes that can lead to an Ischemic CVA are:

- Thrombus (Fixed clot): According researches approximately 45 % of all ischemic CVA's are caused by a thrombus which lodges its self in a blood vessel and obstructs the blood flow to the area located distally to the blocakge. Usually a thrombotic stroke is primarily caused by atherosclerotic plaque in the cerebral arteries. Often the atherosclerotic plaque in the cerebral arteries is due to platelet adhesion, fibrinous coagulations and decreased fibrinolysis activity.
- Emboli (Migraiting clot): About 20 % of all ischemic CVA's are caused from emboli resulting in embolism. Emboli's are flowing bodies inside the blood stream of the cerebrum in various forms such as dislocated thrombus, fats, air inside the cerebral bloodstream E.T.C. that can get stacked inside a cerebral artery and cause occlusion to the cerebral circulation.
- Less Common Causes Of Ischemic CVA's: Includes carotid dissection, the presence of coagulopathies, arteritis, acute infection and severe drug abuse [7, 9, 11, 15, 17 , 18].

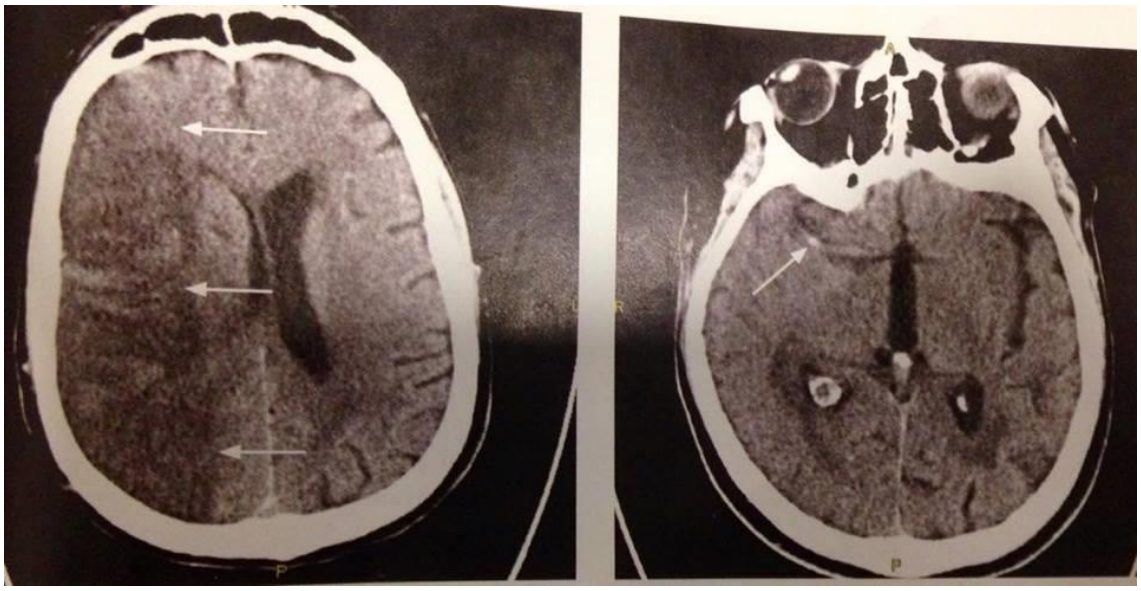
2.4.3 Risk Factors of Ischemic CVA

Risk Factors that can contribute to a possible ischemic CVA include: Diabetes, cardiac disorders such as ischemic heart disease, valvular heart disease, endocarditis, artial fibrillation, or post-cardiac surgery patients along with high blood pressure have and increased risk of an ischemic CVA with the risk increasing along with the age. Secondary risk factors that can cause an ischemic CVA include the presence of periodontal disease, smoking, obesity, diet, increased stress and bad life style [9, 17, 19].

2.4.4 Pathophysiology of Cerebral Ischemia.

In a physiological brain, the blood perfusion is usually around between 50-60ml per 100g of brain tissue. An ischemic CVA is the result of a dramatic decrease in brain perfusion in an area of the brain or even the entire brain with the disrupted neuronal function and the clinical signs to appear if the blood flow decreases under 20ml pes 100g of brain tissue which is a consequence of the brain ischemia. The area affected by the Ischemia will determined by the distribution of the affected artery.

The two main pathophysiological changes occurring during and Ischemic CVA are the decrease in the oxygen and glucose supply due to the vascular occlusion and also various cellular metabolic changes. If the occlusion to the brain substance is complete severe damage can occur with the necrotic tissue swelling rapidly primarily due to the excessive intercellular and intracellular water content and also because of the lack of oxygen. The vascular lesion results to the release of neurotransmitters like glutamate and aspartate by the ischemic cells leading to irreversible cellular damage. The cerebral edema begins within few minutes after the ischemia occurs and reaches its peak at about four days after when the residual deficits will start becoming clear. The edema usually disappears completely approximately 3 weeks after the Ischemic CVA, if the edema is really severe it can increase dramatically the intracranial pressure to the point of even causing contra-lateral and caudal shift of brain structure. [11, 15]



Figures 3 and 4: Left: CT scan showing ischemia in the flow of MCA. Right: Thrombus in the MCA of the same patient causing the Ischemia

2.4.5 Epidemiology and Prognosis

Cerebrovascular accidents are becoming a typical cause of disability mostly in the elderly people. The incidence of Cerebrovascular accidents in Czech Republic is about 350 cases per 100.000 people annually and as a result up to 35.000 people are affected by CVA in the Czech Republic. Approximately the two-thirds of those patients survive while approximately half of the will present severe disabilities after surviving the CVA. More than the one-third of these patients appears younger than 60 years of age [11].

2.4.6 Clinical Manifestation of Ischemic CVA

Sensory Deficits

The sensory deficit appearing after an Ischemic CVA depends upon the side affected and also on the extent of the lesion. Senses of touch, pain, temperature and proprioception may be affected. Involvement of the somatosensory area of the parietal lobe of cerebral cortex leads to impaired cortical sensation [17].

Motor Deficits

Immediately after the outbreak of the CVA there is a phase of cerebral shock characterized by Flaccidity and areflexia. This phase could last a few days up till months or remain present during the whole life of the patient depending on the case. Usually that clinical picture progresses to the development of spasticity, hyperreflexia

and mass pathological movement patterns called synergies. In some cases signs mild spasticity could be present in certain groups of muscles like elbow flexors, wrist flexors, quadriceps and calf muscles but spasticity never dominates. According to Bobbath in most cases of CVA there is a common sequence of prognosis incorporated in three phases : Firstly the Flaccid Phase where flaccidity dominates and the majority of the skeletal muscles are hypotonic, Secondly the Spastic Phase where spasticity is developing and gradually dominating, in some cases where spasticity increases to a severe degree the control of voluntary movements is highly impaired and Thirdly the Phase of spontaneous recovery where the degree and progress of recovery heavily depends in the characteristics of each case. [9, 17 , 18].

Musculoskeletal Complications

In about 90% of CVA survivors musculoskeletal complication are presenting if proper rehabilitation plan is absent. Usually it is manifested as the combination of muscular imbalance and inactivity. Various Joints can get stiff and painful and as result decrease of the range of motion is typical. During the flaccid stage there is a high risk of subluxation of the glenohumeral joint in the affected side because of the extensively lowered muscle tone. Also claw hand deformity is a common complication after a CVA [11, 17].

Apraxia

Apraxia is the inability of the patient to perform a desired movement despite the presence of an adequate level of motor control and coordination. It is caused due to lesion of the dominant parietal lobe [9].

Unilateral Body Neglect Syndrome

If a survivor of a CVA is not using the affected limb to its available control and ignores it he/she has developed Unilateral Body Neglect Syndrome. For example a patient with neglect syndrome will wash his/hers unaffected side when having a bath but will ignore to wash the affected side. Also if the patient is not forced to, he/she will perform every functional task without using the affected side or limb of the body [9, 17].

Speech and language disorders/Aphasia

Aphasia occurs in cases where the lesion has affected the dominant parietal lobe. There are three main speech disorders detected in CVA survivors. Firstly Broca's aphasia where the patient has the ability to completely understand everything but his ability to respond by articulating speech is impaired due to the affection of Broca's area.

The second type is Wernicke's aphasia where the patient is able to speak fluently but has difficulty understanding a conversation or a command. And finally the third type of aphasia is Global or Total aphasia where the patient is equally unable to speak or understand and it is a combination of the first two types of aphasia although in this case both Broca's and Wernike's areas are affected [9, 17, 18].

Psychological Dysfunction

Psychological disorders are very commonly seen in CVA survivors and are usually manifested as depression, anxiety, sleep disorders, social withdrawal, behavioral changes and bipolar disorder while dramatic personality changes may appear such as a very introvert person to become extremely extrovert after surviving a CVA [17].

2.5. Therapeutic Approaches.

When a patient arrives at a hospital presenting acute neurological signs that resemble a potential CVA it is important for the doctors to distinguish the type of CVA since an ischemic CVA requires a different medical management from a haemoragic or subarachnoid episode. The diagnosis of a CVA requires a review of the clinical picture concerning objective and subjective data and also it is usually confirmed by a CT brain scan while the doctor must apply a complete neurological examination [8, 10, 12].

Thrombolysis

Around 15% of patients following an Ischemic CVA are suitable for thrombolysis treatment which is a process of breaking up the blood clots, also known as clot-busting involves tissue plasminogen activator (Tpa) which can dissolve the blood clots following an acute ischemic stroke and significantly improve the outcome [4, 18].

Prevention of Secondary Complications

Prevention of secondary complications after an acute stroke has approved to increase the possibility of a better outcome. Treatment of any underlying pathology like regulating hypertension which have been proven to be effective or in more rare cases control fever can preserve from a poor outcome after the CVA, pharmacotherapy is commonly used to prevent such complications [4].

Surgical Treatment

There are various surgical applications used for patients that suffered from an ischemic stroke depending on the individual pathology of each case. Hemicraniectomy have been seen used for regulation of increased intracranial pressure if the cerebral edema resulted from the ischemic CVA is very large. Other surgical procedures that are

applied in such cases are carotid endarteretomy or intracranial/ extracranial bypass which can assist increasing the blood perfusion in the brain, angioblasty and carotid stenting has been used as well although such procedures are rarely performed to patients with acute neurological signs [9, 15].

2.5.1 Physiotherapeutic Approach

It is important for a physiotherapist who is going to take over a patient after a CVA to perform of list of examinationa from a physiotherapeutic point of view and carefully evaluate the results in order to construct and apply a targeted and successful rehabilitation plan while paying much attention to the medical history of the patient and making sure to retrieve a detailed anamnesis record. The list of examinations recommended for physiotherapist's point of view in a case of an Ischemic CVA includes:

- Observation
- Examination of higher functions
- Postural examination
- Gait examination
- Breathing examination
- Anthropometric measurements
- Soft tissue examination by Lewit
- Examination for spasticity
- Muscle tone examination (palpation)
- Rom Examiation (SFTR Method) according Russo and Gerhard
- Neurological examination
- Examination of ADL activities and Functional assessments

The therapy plan of course depends on the case and varies widely according the phase of the patient, the present state of the patient, the manifestation of the disease in the specific patient, the physical and mental state of the patient and many other factors and variables. That is why a rehabilitation plan of a CVA survivor is constantly involving in analogy with the progress of the patient and the phase he/she is [2, 10 , 11 ,14]

Positioning

Positioning is utilized during the acute phase and in some cases during the sub-acute phase after a CVA**.** Positioning has been proved to be an important part of the rehabilitation after CVA preventing of musculoskeletal deformities, fast development of spasticity, pressure ulcers, circulatory dysfunctions, and also it can assist in the recognition and awareness of the affected side. Preferably the patient is positioned in side or supine lying. A slight change in the position of the patient every few hours can stimulate the sensory functions that have been affected. Positioning should be performed every 2-3 hours in a 24 hours schedule. Pillows are used which can be classic pillows or special pillows for positioning. One of the fundamentals of positioning is to set the major joints which being the hip and shoulder in neutral positions while the extremity position requires to be on anti-spastic patterns. Also the distal parts of the extremities must be placed in such position where their function is facilitated [10, 11 , 12 ,17 ,22].

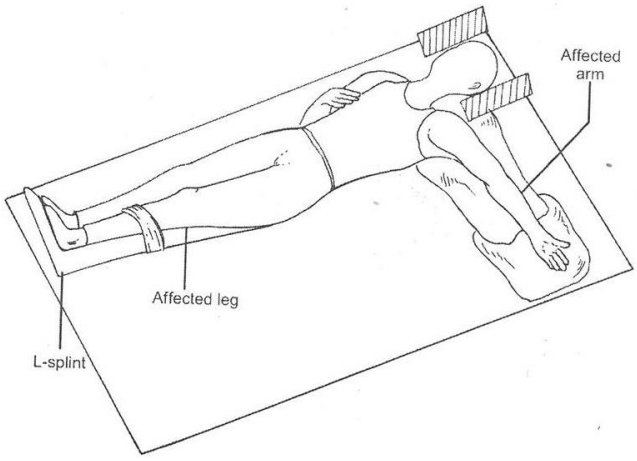


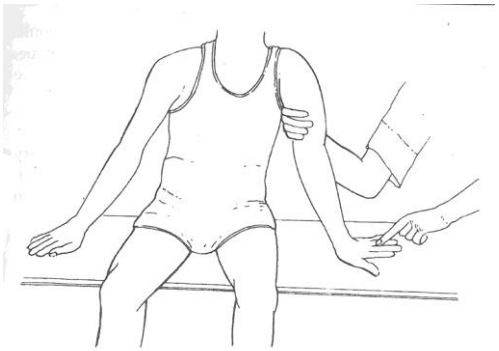
Figure 5: Positioning In Supine.

Mobilization and stretching

When the flaccidity is dominant in the acute or the sub-acute phase mobilization in the form of slow passive stretching exercises should be given in order to prevent tightness of various biarticular muscles. Muscles like the wrist flexors, hamstrings, triceps surae, adductors, tensor fascia latae and Achilles tendon should be stretched. Passive exercises should be given in all joints, for all movements for at least 10 repetitions and repeated 3-4 times per day [3, 5, 13 , 19]

Weight Bearing Activities

Weight bearing exercises are utilized in order to promote development of muscle tone in the affected side and also promote awareness of the paretic side if present. Activities like bridging, sitting with weight bearing to the affected side and standing should be performed as much as possible while taking in consideration the limitations that could appear by the patient's medical status [5, 17].



Figures 6 and 7: Left: Weight Bearing through affected upper limb. Right: Facilitating weight transmission to the affected side.

Breathing Exercises

Breathing exercises should be performed in order to maintain and promote ventilation, prevent secretion accumulation and also activate and facilitate abdominal breathing. Also in some cases Vojta's breathing exercising method has been successful facilitating diaphragmatic breathing [11,17].

Joint Play Therapy by Lewit

During any phase after a CVA the joints can emerge restricted Joint Play. Mobilization of those joints according Lewit can assist in the increase of range of motion and also improve the general condition of the patient. Mobilization of scapula has been proven to be effective during all the stages [14].

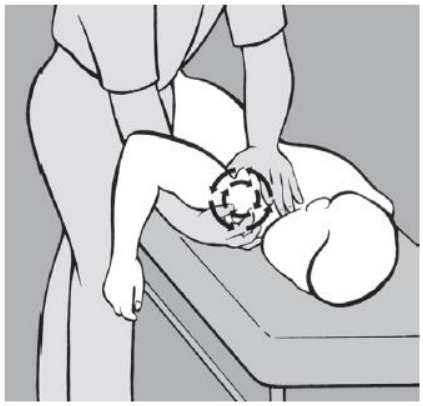


Figure 8: Non-Specific Mobilization of Scapula according to Lewit.

PNF (Propreoceptive Neuromascular Facilitation)

PNF can be used during the physiotherapeutic sessions in order to facilitate the affected muscles impaired by the motor deficits after the stroke and also generally improve motor function. PNF uses feedback from the proprioceptive system of the body in order to facilitate the muscles. Both strengthening and relaxation techniques according PNF can be used depending on the goals of the therapy plan. Rhythmic irritation technique for example can be used to assist the education of a movement [12, 20, 22]

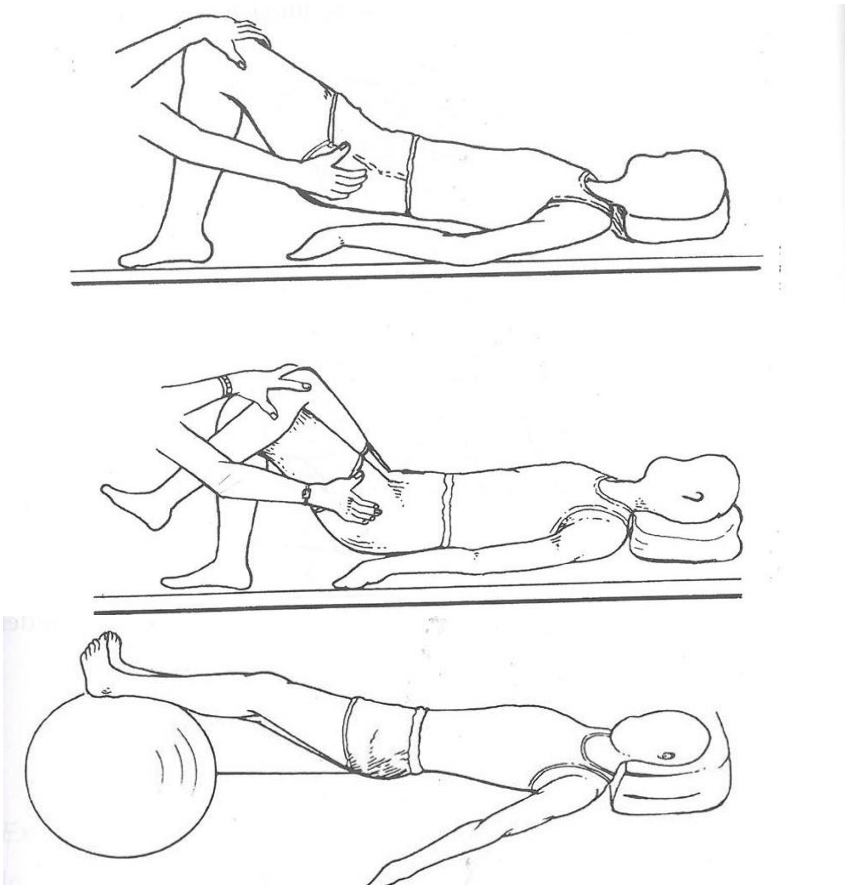
Balance Exercises

Exercising balance is a really good way to promote a more stable and balanced gait for a patient after an ischemic stroke while also assists in the prevention of accidents during gait and lowering the risk of falling. Sensomotoric training could be included to the therapy plan in order to facilitate propreoception and in extension assist in the goals mentioned above [17, 22].

Strengthening and Conditional Exercises

Patients that have survives an acute ischemic CVA are mostly likely to present muscle weakness and lack of muscle coordination. Strengthening the weak muscles while forcing the patient to improve his coordination and balance is really important during the rehabilitation plan while having a major role to the progression of the clinical picture and the functionality of the patient as far as ADL is concerned. Also strengthening of the big muscle groups will further stabilize the joints of the body and will prevent complications involving the joints. The exercises should target various factors such as mobilization of joints, strengthening of big muscle groups, Improvements of the balance and improvement of coordination should be concerned. The exercises could be progressing and involving along with the patient's progress. For example the bridging exercise which is one of the fundamental exercises during a rehabilitation plan for a patient after stroke could be modified to suit patient's current medical status, physical level and functionality and gradually evolve to more demanding versions as the patient improves. For example we can start by just asking the patient taking the basic position to perform a bridging exercise in supine position with bended knees and place an over ball between the patient's legs. Firstly we can just ask the patient to posterior tilt his pelvis and return to starting position, when the patient adapts to that we can ask him to elevate his body after tilting his pelvis, then after a period of time in order to make the exercise more challenging we can remove the over

ball between the patient's legs and when he masters that to ask him to elevate his body by bridging with just the affected lower extremity or supporting his lower extremities to a vestibular ball in order to make the exercise even more challenging. That example is a good demonstration on how to incorporate modification of exercises to the rehabilitation plan and gradually involve them when the patient starts to adapt [1, 3, 13, 20].



Figures 9, 10 and 11: From Top to bottom: 1-Classic Bridging exercise, 2-Bridging with weight bearing in affected LE. 3-Bridging on vestibular ball.

Verticalization of the patient and gait training

Verticalization is one of the primary goals of the short term rehabilitation plan of a patient after CVA in sub-acute phase. The physiotherapist must instruct the patient how to transfer from lying to sitting position and from sitting to standing position with assistance if required. Gait training is also crucial regarding the progression of the patient and of course the ADL. Usually a patient in the subacute phase will require and assistive device like a walker in order to perform gait. The physiotherapist must firstly ensure patient's safety and prevent the possibility of falling and secondly instruct the

patient how to use the walker and also using a walking stereotype such as 3 point alternate gait. We should be forcing the patient to weight bearing the affected lower limb as much as possible in order facilitate the affected side and also facilitate a wide base of support. Dorsal flexion is usually absent in patient with hemi paresis and we should try to stimulated using visual stimuli of the patient in lying and then in standing position. The use of Funtional Electrical Stimulation Device such as the Walkaide have been proven to facilitate dorsiflexion and improve gait in patients after CVA [11, 17 , 22]

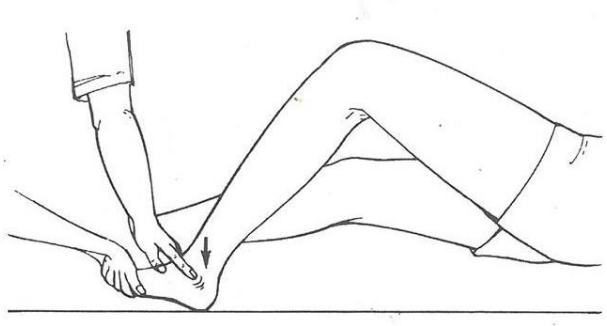


Figure 12: Facilitation of Dorsal Flexion of the foot could be really beneficial prior to verticalization.

ADL Training

One of the main goals of a rehabilitation plan after a CVA is to restore patient's independency as much as possible and a major component of that goal is to restore patient's ability to perform basic daily activities. We can instruct the patient to repetitively practice an ADL task that has issues performing by asking him to perform it very slowly and gradually increase the speed to a physiological level. Also instruct him to use visual stimuli as much as possible which will help me coordinate and consolidate the ADL task like feeding himself better and better every time he repeats it [12, 17, 22].

Physical Therapy

Physical therapy modalities can be applied to control pain, reduce spasticity, improve torpidity, reduce edema, facilitate muscle contraction and improve proprioception. To achieve some of these goals such as reducing spasticity Whirpool can be used. Electrical modalities can be used as well. The TENS can provoke and additional sensory imput to the Central Nervous system by causing pre-synaptic inhibition of the suprasegmental pathways [11].

2.6 Occupational Therapy

Occupational therapy can further assist to restoring the functional independence of the patient in also improve his ability to perform basic ADL. The occupational therapist is responsible to instruct the patient on how re-learn daily activities and self care like cleaning him/herself or using a fork and a knife to eat. Each therapy is individually suited to the needs and goals of each patient and will usually focus in the fine motor skills of the hand required for many daily activities [11, 12]

3. Special Part (Case study)

3.1 Methodology

My clinical practice took place at Oblastni Nemocnice Kladno and took place from Monday 18-01-2016 until Friday 29-1-2016. Each daily practice at the hospital lasted 8 hours with the total amount of my practice being 80 hours.

My clinical practice was supervised by Bc. Thomas Modlinger while my bachelor thesis was supervised by Mgr. Helena Vomackova. During my practice I had 7 physiotherapeutic sessions with my patient in the period of 9 days starting from Thursday 21/01/2016 and concluding on the last day of my practice Friday 29/01/2016.

The patient was fully aware of the examinations and therapeutic procedures at any given time of my practice and no invasive methods were used. During the examination and the therapy procedures I only used techniques that I studied at the faculty of Physical Education and Sport of Charles University of Prague during the span of the bachelor degree program of physiotherapy that I attended.

My bachelor thesis has been approved by the ethics Committee of the Faculty of Physical Education and Sport of Charles University of Prague.

3.2 Anamnesis:

- Gender of the examined person: Male
- Initials of the examined person: H.A.
- Year of birth: 1940
- Diagnosis: Ischemic Cerebrovascular Accident (Stroke) In Sub-Acute Phase.
- Medical Code: I635

3.2.1 Status Presents:

The patient arrived at Nemocnice Kladno on 19/01/2016 (my first session with him took place one day after, 20/01/2016). At that time the patient was 3 weeks after the ischemic episode which was later confirmed as an Ischemic Stroke at the hospital Na Homolce. The Patient was generally weak and a little bit confused at times. His Right Side is the affected one and with the lower extremity being more affected in comparison to the upper extremity. The level of paresis of the patient, on the first day at the Kladno Nemocnice was adequate for the Doctors to suggest early signs of Neglect syndrome. The patient was not independent and needed assistance for most of the basic daily activities such as eating, use the toilet (he had a urinary bladder catheterization placed) and move to sitting from lying position. Due to the weakness and the paresis the patient cannot walk or get up from the bed alone and it is almost impossible for him to even walk with assistance or a walker devise, except getting up with the assistance of another person and trying to do one or two steps with full assistance and without any weight bearing of the right lower extremity, also it was written in the medical report of the patient that there is a high risk of falling if is in upright position if he attempts to walk. According the Doctor (to whom I did not speak directly and do not know his/hers exact specialization or Name) the patient is able to orientate and communicate but on the first day he seemed to have mild signs of aphasia and although he was conscious during a conversation he seemed to have problems to express himself with the correct words.

Height: 168 cm

Weight: 60 Kg

BMI: 21.3

Blood pressure: 120/70mmHg

Heart pulse: 74/minute

Body Temperature: 36, 2 C^{o}

3.2.2 Anamnesis According Current Diagnosis

The patient had an ischemic episode on 25/12/2015 Christmas day. While he was sitting in a chair in his living room he suddenly felt weak and fatigued, that was followed by numbness on the right side of his face and the loss of the ability to speak and communicate. Moreover the patient was not able to get up from the chair and walk. The patient lives outside of Prague and he was immediately transported via helicopter to Nemocnice Na Homolce in Prague where he underwent Thrombolysis and received anticoagulant injections as an emergency. It is important to mention that the patient was submitted to an MRI (Magnetic Resonance Imaging) and a CT scan (Computed Tomography) with both examinations confirming the cerebral ischemia in the Middle Cerebral artery (MCA), a finding which verified the diagnosis of the Stroke. According the documentations of the examinations that the patient underwent the part of the brain affected by the ischemia had the size of a golf ball and was located in the left hemisphere affecting parts of the Frontal and the Parietal Lobes. Moreover According to the medical reports during his staying at the Nemocnice Na Homolce the patient was completely dependent on assistance as far as basic daily activities or transfer from the bed goes. Moreover the patient could not speak at all or move his right lower and upper extremities the first couple of days he spend ad Na Homolce. Again according the medical reports from Na Homolce the patient was really flaccid during the acute phase after the stroke and his therapy plan mostly included positioning, breathing exercises and passive movements. I should mention though that I did not have a full transcript of the therapy plan of the previous hospital other than the general information I got from the patient and mentioned above.

3.2.3 Personal Anamnesis

The patient has a significant amount for hearing loss in the right ear as a result of a rapture of his tympanic membrane after a head injury about 20 years ago.

The patient had a rupture of his anterior cruciate ligament on his right knee joint after jumping from a moving bike in order to avoid a potential crash when he was 50 years old. The patient only received conservative treatment for his injury , he had rehabilitation for about a month in a physiotherapy center.

The patient is suffering from Ischemic heart disease which according the doctors played a major role as the cause of the strike.

The patient is suffering from supraventricular tachycardia (SVT) which originates in the atrioventricular node of his heart.

According the Doctor's report the patient is hypertensive.

According the Patient's blood tests records the levels of the hepatic and liver enzymes in his blood are above the normal.

3.2.4 Pharmacological Anamnesis

The patient is under the following medication at the current time. He is having one or two of the following medicines at 4 different times during the day: 06:30, 11:45, 16:45, and 22:00.

-Warfarin 5mg
-Prenessa 8mg
-Egilok 25mg
-Buronil 25mg
-Rosucard 10mg

3.2.5 Family Anamnesis

Patient's father died of lung cancer when he was 77 years old.
Patient's mother had ischemic heart disease as well. She died when she was 82 years old from cardiac arrest.

3.2.6 Social Anamnesis

The patient lives in a two-floor house with his family. His son lives in the first floor and the patient lives with his wife in the second floor.
There is no elevator in the house the patient has to walk around 20 steps on the stair in order to get in his house.

3.2.7 Abuses

The patient used to be a cigarette smoker, although he quit smoking 17 years ago.
The patient will usually drink a glass of wine once or twice a week.

3.2.8 Allergies

None

3.2.9 Hobbies-ADL

He used to take a walk everyday in a park near his house until he had the stroke.
He used to bike a lot but that became rare as he got older.

3.2.10 Occupational Anamnesis

The patient is a Pensioner.
The patient is a retired factory worker. He used to have a position in a chemical factory.

3.2.11 Operation Anamnesis

The patient had an operation for tympanic membrane about 20 years ago when he perforated his eardrum. Even after the surgery the hearing loss acquired from the accident remained present until today.

3.2.12 Previous Rehabilitation

As already mentioned above the patient was immediately transported to Nemocnice na Homolce after he suffered the stroke where he also spend the first 3 weeks after it, during the acute stage. The patient's condition during the acute stage was mostly characterized by flaccidity and weakness so the rehabilitation plan there focused on diminishing those but I did not much more information about the rehabilitation plan the patient underwent during the acute stage at the previous hospital except that there was regular positioning of the patient for controlling the development of spasticity and prevent complications. Also the patient received gentle passive exercises for mobilization and stretching and some breathing exercises in daily basis as well.

The patient had rehabilitation about 24 years ago after a rapture of his anterior cruciate ligament on his right knee. The treatment was strictly conservative but the patient could not recall much of the rehabilitation process other than he did some strengthening exercises but nothing in greater detail.

3.2.13 Excerpt from Patient's Health Care File

After suffering from the stroke the patient was submitted to a CT, and an MRI examination which all confirmed that the episode that led the patient to the hospital Na Homolce was actually an ischemic CVA or more commonly known Stroke which originated in the Middle Cerebral Artery (MCA) and affected parts of the frontal and parietal lobes of the cerebral cortex. I was presented these files but I could not use them in my thesis since they were property of Na Homolce Hospital and of my patient.

The patient was also submitted to an ECG which showed signs of Ischemic Heart Disease (the patient was previously diagnosed with it) and also Supraventricular tachycardia.

3.2.14 Indication For Rehabilitation

The doctor has indicated a rehabilitation plan which will be focusing on the verticalization of the patient with the first approachable goal being the ability to safely transfer himself in small distances with some assistive device like a walker and also regain the ability the and improve the quality of patient's independence as far as ADL goes, changing between basic position such as from sitting to standing and via versa or rolling from one side of the bed to the other are mentioned in doctor's indication as well. Also we should be preventing the ignorance that the patient may have developed on the paretic side. For the goals mentioned above we will be using some of the following treatment methods: Exercises that will concentrate on facilitating and strengthening the muscles of the paretic side, electro stimulation is also indicated for facilitating theese muscles as well. Passive exercises that will help the stretching of various muscles that are shortened or have a tendency to develop spasticity and also will be increasing the mobility of the patient when taking the form of general mobilization, those exercises will be accompanied with stretching of skin, subskin and the fascias in the form of soft tissue techniques which will further improve the mobility of the patient. For the Joints that have a tendency to remain blocked we should be using Joint play in order to further mobilize them. Exercises that will be emphasizing the improvement of balance including sensomotoric training that will be possible for the patient to manage in his state will have an important role during the rehabilitation. Moreover respiratory exercises will be used to maintain the lung compliance, weight bearing activities in

order to promote the development of muscle tone and generally improve the condition of the patient. Last but not list we should be using functional tasks that will help the patient improve his skills in ADL activities, we can ask the patient to practice and repeat actual ADL tasks that he has problem completing such as putting his socks on etc. and we can work with the Ergotherapist of the hospital to achieve that.

3.2.15 Differential Balance

Since we are already aware of the actual diagnosis we can hypothesize some of the outcomes of the stroke that we could probably be dealing with during the rehabilitation. As already mentioned the patient suffered an ischemic stroke and right now he is approximately 3 weeks since that happened. That means that we are probably just over the acute phase after the stroke and we are entering the sub acute phase .We should be expecting some general weakness of the patient, flaccidity could be still present. The patient could have issues with voluntary movement control especially in the paretic side, problems with coordination, fine motor skills etc. It is possible that the patient is neglecting his paretic side, which could be remaining in apraxia and there is a probability that the patient is only relying to the non-paretic side for functional tasks. As far as the examination goes we should be expecting some hyperreflexia in deep tendon reflexes since we are dealing with a central lesion of the CNS, also we should be expecting some positive paretic signs. Also the patient may have issues with his deep sensation. As far spasticity goes according the doctors is not present yet so there is a possibility for the spastic signs to be negative but it (the spasticity) may have started developing. We can expect some restriction on the soft tissues as well. The ROM is expected to be limited in almost all the joints and we can hypothesize that we would be dealing with some joint play restriction as well. Last but not least the patient will probably have difficulty completing various functional tasks and ADL activities.

3.3 Initial Kinesiologic Examination:

This is the examination plan that should be covering a wide spectrum of examinations and tests, while keeping in mind the diagnosis we are dealing with, in order to have a targeted and successful therapy plan. The examination plan includes:

- Observation
- Examination of higher functions
- Postural examination
- Gait examination
- Breathing examination
- Anthropometric measurements
- Soft tissue examination by Lewit
- Examination for spasticity
- Muscle tone examination (palpation)
- Muscle Length Test by Janda
- ROM examination (SFTR Method) according to Russe and Gerhard
- Joint play examination by Lewit
- Neurological examination
- Examination of ADL activities and Functional assessments

3.3.1 Observation

The patient seems to be in a good mood even though he is tired. While speaking to him in order to take the anamnesis he seemed confused at times. The patient was only speaking Czech so for the most part my supervisor was translating for me and he told me that while speaking a lot of times the patient used words that did not make any sense or he was just confusing words although he seemed to know what he was willing to say he just had trouble executing that. For example during the anamnesis he told as that his mother died and 19 years ago and seconds after he told us that his mother was going to visit him later when in fact his wife was going to visit him. So the patient actually knew that his mother was dead and that the person that was going to visit him was his wife but during conversation he keep referring to his wife as his mother, he did several similar mistakes during the conversation suggesting signs of mild aphasia as reported by the doctors but it is important to make clear that patient's perception was perfect. As far as facial symmetry goes patient's face seemed pretty symmetrical by just observing him. While lying on the bed his right upper extremity appeared with semi flexed elbow joint, the forearm was kept in pronation with the wrist and fingers kept in flexion. The right lower extremity's notable findings were the mild hyperextension of the knee joint and the plantar flexion of the foot.

3.3.2 Examination of Higher Functions

* In order to examine the higher functions such as memory, intelligence, consciousness, behavior, orientation and speech we used a version of Mini-Mental State Examination (MMSE) while collaborating with the Ergotherapist of the hospital. We asked the patient some questions and assigned him some tasks and we scored each one of them according the outcome and the ability of the patient to execute the task.

- We asked the patient What is the year? Season? Date? Day of the week? Month? SCORE: 5/5
- We asked the patient "Where are we now Country? Town/city? Hospital? Floor? SCORE: 5/5
- We named three objects (a pencil, a watch and a phone) and we asked the patient to repeat all of them. SCORE:3/3
- We asked the patient to count backward from 100 by sevens. SCORE: 4/5, *the patient did some minor mistakes in the numbers.
- We asked the patient to repeat naming the tree objects we named before. SCORE: 2/3
- We showed the patient two objects (a paper and a small soft ball) and ask the patient to name them. SCORE: 2/2
- Asked the patient to repeat the phrase: Prague's first steamboat in Czech (prvni prazska paroplavba). SCORE: 0/1, the patient had trouble repeating the phrase correctly and misspelled the words.
- We asked the patient to take a paper fold it in half and put it on the floor. 2/3
- We showed the patient a paper which said close your eyes and asked the patient to do what it says. SCORE: 1/1
- We asked the patient to form a sentence using a noon and verb. SCORE: 1/1
- We showed the patient a picture of two hexagons that are intersecting with each other and we asked the patient to draw what he saw in a blank paper. SCORE: 0/1

TOTAL SCORE: 25/30

*A score from 25/30 up to 30/30 is considered physiological according to the MMSE.

3.3.3 Postural Examination

* I should mention that the initial postural examination took place in my first meeting of the patient. At that time the patient could not stand without a high walker with weels in which he was supporting his forearms and also the assistance of my supervisor since there was high risk of falling even with the walker, my patient was pretty unstable and there was non-weight bearing in the right lower extremity. The point is that this is not an examination of patient's actual posture but his posture at this time using an assistive devise.

Posterior View:

- No weight bearing in left lower extremity.
- Whole body is tilted to the Left side.
- Adduction of the right hip
- Left shoulder slight higher than the right.
- Both shoulders elevated
- Head slightly sifted to the Left

Lateral View (left side)

- Slightly flexed left knee.
- Left hip slightly flexed.
- Semi-flexed trunk.
- Lumbar spine appears flat*.
- Thoracic spine in kyphosis*.
- Right shoulder appears protruded.
- Cervical spine flexed*

Lateral View (right side)

- Right ankle plantar flexed.
- Right knee slightly flexed.
- Right hip flexed.
- Semi-flexed trunk.

- Lumbar spine appears flat*.
- Thoracic spine in excessive kyphosis.
- Right shoulder appears protruded.
- Thoracic spine in kyphosis*.
- Cervical spine flexed.

Anterior View

- Right foot is almost “hanging” in inversion and plantar flexion (Seems like dropped foot phenomenon)
- Right foot appears longer than the left foot probably because of the plantar flexion but we should wait and see the outcome of the anthropometric measurements to see if is structurally longer as well.
- Slightly flat longitudinal arch of left foot.
- Slightly flat transverse arch of left foot.
- Right foot is excessively external rotated.
- Left foot is slightly external rotated
- The patient cannot retain a stable posture he keeps moving his right foot back and forth without putting any weight on it in order to keep his balance.
- Right knee is slightly flexed.
- Both knees in slight valgosety.
- Adduction of the right hip.
- Left shoulder slight higher than the right.
- Head slightly sifted to the right.

*As mentioned in the prologue of the postural examination the patient stud with a high walker with weels supported by his forearms. The stability of the patient was poor and he had to look at his lower extremities in order to retain his balance since there was not any weight bearing in the right side. I just wanted emphasize the findings concerning the whole spine with the flat low back, the excessive kyphosis in the thoracic spine and the flexed cervical spine which were highly influenced by the fact that the walker was set a little lower that it should have been in analogy with the height of the patient and that the patient was looking at his lower extremity the whole period of the examination in to retain his balance as mentioned already.

3.3.4 Gait Examination.

*The initial gait examination took place the first day I met with the patient. The patient could barely make a few steps using the high walker with wheels where he was supported by his forearms and the assistance of me and my supervisor.

The patient was really uncomfortable and afraid to try to walk even with the assistance. He did four to five steps and then he said that he felt weak and fatigued so me and my supervisor had to stop the examination and return the patient to his bed. The patient had his neck flexed and was looking at his foots and floor the whole time of the examination. The steps were really lacking quality and appropriate length. The right being plantar flexed and inverted (dropped foot) was having first contact with the floor mostly with the lateral surface. The patient was weight bearing exclusively the left, non paretic lower extremity. He was also stepping mostly with the left foot, when he was trying to step with his right, paretic foot he was practically almost "dragging'' it rather than making a step and was putting a lot of effort to his forearms which were supporting him on the walker in order to bear his weight. One of the interesting parts of this short examination is that practically, the patient did not move any forward even after attempting 5 steps, we can even say that the opposite happened and the patient was a little behind of his initial position after the steps. In my opinion there were two main reasons for that finding, the first being that the patient tried to make bigger steps with his non-paretic, left lower extremity than he could handle so every time he stepped forward because of the excessive length (the actual length of the step was small in comparison with a healthy person's step but long for him to handle) of the step he was starting to lose his balance so he would immediately be stepping back with the left foot in order for him to gain some stability. The other reason that he did not move forward is that every time he tried to step with his paretic, right lower extremity by ''drugging'' his left foot forwards he had to step backwards a little bit with the non-paretic foot which was bearing his weight along with the walker in order to retain his balance. Moreover I should mention that there was not active knee flexion or extension in the paretic lower extremity. As far as the step goes the toes, mid-foot and heal all made contact with the floor at the same time, the swing and the stance phase were absent. The general posture of the patient was similar with the findings of the postural examination since the patient was almost still. I should mention that there was an increase of tension every in the upper extremity every time the patient was stepping with the left, non

paretic lower extremity which is logical since every time the non paretic lower extremity was not in contact with the floor the patient was fully loading his arms which were supporting him in the walker he used for assistance. Last but not least the patient had a slight tilt to the left side of his body.

3.3.5 Breathing Examination

During the breathing examination the patient was lying to his bed in supine position with his knees flexed. The patient was not using properly the abdominal wall while breathing, especially the lower abdominals. The patient had mainly superficial breathing using mostly his upper thorax. The movement and mobility of the ribs seemed physiological.

3.3.6 Anthropometric Measurements

Lower Extremities	**Left LE**	**Right LE**
Functional length ASIS	90 cm	90,5 cm
Anatomical length	83 cm	83,5 cm

Table 1- Initial Anthropometric Measurements For Length Of Lower Extremities.

Lower Extremities	**Left LE**	**Right LE**
Thigh (15 cm above knee)	42 cm	40 cm
Thigh (10 cm above knee)	38 cm	36 cm
Knee	34 cm	34 cm
Calf	30 cm	29 cm
Ankle	29 cm	29 cm
Foot	25 cm	25 cm

Table 2- Initial Anthropometric Measurements For Circumference Of Lower Extremities.

3.3.7 Soft tissue examination by Lewit

During the soft tissue examination the main finding concerned the fascias of the lower extremity and more specifically there was restriction in the fascias of the anterior part of the thigh in cranial and caudal direction and also of the calf in medial and lateral direction. The fascia restriction was apparent in both lower extremities with the fascias of the right thigh and calf being more restricted in comparison with the left one.

The skin and subskin of the lower extremities appeared non restricted during the soft tissue examination.

*There was not any restriction of the fascias nor the skin and the subskin in the upper extremities and also in the area of the neck.

3.3.8 Examination for spasticity

In order to examine the patient for spasticity I used the Modified Ashworth Scale. The patient was placed in supine position, the scale is based on rapid passive movement which can create a stretch reflex or a clasp knife response caused by the increased muscle tone. The Modified Ashworth Scale includes a scoring : 0- no increase in muscle tone, 1-Slight increase in muscle tone accompanied by a resistance at the end of range of motion, 1+ Slight increase in muscle tone accompanied by a resistance throughout (less than half) Range of motion, 2- More marked increase in muscle tone throughout most of ROM with the affected parts easily moved, 3- Considerable increase in muscle tone with difficult passive movements, 4- The joint is rigid in flexion and extension.

*We provided the examination in the right, affected upper extremity. The results were listed in the following table:

Joint Examined	Score
Flexion of the wrist	0
Extension of the wrist	2
Extension of the fingers	2
Extension of the elbow	0
Extension of the elbow	0

Table 3- Initial Examination For Spasticity According To Modified Ashworth Scale.

3.3.9 Muscle tone examination (palpation)

I provided palpation to the following muscles in order to distinguish the level of their muscle tone. The following tables list the findings of the examination:

Upper extremity		
Muscle	**Left**	**Rig**
M. Biceps Brachii	Physiological	Physiological
M. Triceps	Physiological	Hypotonic
Pectoralis Major	Physiological	Physiological
Supraspinatus	Hypotonic	Hypotonic
Infraspinatus	Hypotonic	Hypotonic
Deltoid (Anterior)	Physiological	Physiological
Deltoid (Middle)	Physiological	Physiological
Deltoid (Posterior)	Physiological	Physiological
M. Brachioradialis	Physiological	Hypertonic
M. Pronator teres	Physiological	Hypertonic
M. Flexor carpi radialis	Physiological	Hypertonic
M. Flexor carpi ulnaris	Physiological	Hypertonic
M. Extensor carpi radialis	Physiological	Hypotonic
M. Extensor carpi ulnaris	Physiological	Hypotonic
Lower extremity		
Muscle	**Left**	**Right**
M. Tensor fascia latae	Hypotonic	Hypotonic
M. Rectus femoris	Hypotonic	Hypotonic
M. Vastus lateralis	Hypotonic	Hypotonic
M. Vastus medialis	Hypotonic	Hypotonic
M. Sartorius	Hypotonic	Hypotonic
M. Adductor magnus	Hypotonic	Hypotonic
M. Illipsoas	Hypotonic	Hypotonic
Gastrocnemious	Physiological	Hypotonic
Soleus	Physiological	Hypotonic
Tibialis anterior	Physiological	Hypotonic

Table 4- Initial Examination of Muscle Tone By Palpation.

3.3.10. Muscle Length Test Examination by Janda

*This examination was the only one provided apart from the rest of the initial examinations since I was not planning to use it due to the patient's diagnosis. Although, during the first therapy my supervisor indicated passive stretching of triceps surrae and the hamstrings I decided to examine those muscles although the limited R.O.M was already pretty apparent.

Muscle	Left	Right
Gastrocnemius	1	2
Soleus	1	2
Hamstrings	0	2

Table 5- Initial Examination of Muscle Length according to Janda

3.3.11 ROM examination (SFTR Method) according to Russe and Gerhard

The examination of the Range Of Motion according the SFTR method took place in my first session with the patient which took place in his second day at Oblastni Kladno Nemocnice. The patient was only feeling comfortable to be examined in supine line position so some joint movements which required prone or side line position were not examined as a result. In order to execute the examination I used a metallic goniometer.

The results are listed in the following tables:

HIP JOINT				
Plane	**Left side**		**Right side**	
	Active Movement	**Passive Movement**	**Active Movement**	**Passive Movement**
S	*0º – 0º – 110º	*0º – 0º – 130º	*0º – 0º – 65º	*0º – 0º – 110º
F	25º – 0º – 25º	35º – 0º – 25º	25º – 0º – 20º	35º – 0º – 20º
Rs	*0º – 0º – *0º	45º – 0º – 20º	*0º – 0º – *0º	30º – 0º – 20º

Table 6- Initial Range of Motion of Hip Joint.

KNEE JOINT				
Plane	**Left side**		**Right side**	
	Active Movement	**Passive Movement**	**Active Movement**	**Passive Movement**
S	$0^o – 0^o – 120^o$	$0^o – 0^o – 130^o$	$0^o – 0^o – 110^o$	$0^o – 0^o – 120^o$

Table 7- Initial Range Of Motion Of Knee Joint.

ANKLE JOINT				
Plane	**Left side**		**Right side**	
	Active Movement	**Passive Movement**	**Active Movement**	**Passive Movement**
S	$0^o – 0 – 50^o$	$10^o – 0 – 60^o$	$-10^o – 0 – 40^o$	$0^o – 0 – 60^o$

Table 8- Initial Range of motion of ankle joint.

SHOULDER JOINT				
Plane	**Left side**		**Right side**	
	Active Movement	**Passive Movement**	**Active Movement**	**Passive Movement**
S	$*0^o – 0^o – 160^o$	$*0^o – 0^o – 175^o$	$*0^o – 0^o – 125^o$	$*0^o – 0^o – 155^o$
F	$0^o – 0^o – 150^o$	$0^o – 0^o – 160^o$	$0^o – 0^o – 120^o$	$0^o – 0^o – 140^o$
R	$90^o – 0^o – 60^o$	$90^o – 0^o – 85^o$	$60^o – 0^o – 75^o$	$90^o – 0^o – 90^o$

Table 9- Initial Range of motion of shoulder joint.

ELBOW JOINT				
Plane	**Left side**		**Right side**	
	Active Movement	**Passive Movement**	**Active Movement**	**Passive Movement**
S	$0^o – 0^o – 145^o$	$0^o – 0^o – 145^o$	$-5^o – 0^o – 145^o$	$0^o – 0^o – 145^o$

Table 10- Initial Range of motion of elbow joint.

RADIOULNAR JOINT				
Plane	**Left side**		**Right side**	
	Active Movement	**Passive Movement**	**Active Movement**	**Passive Movement**
R_s	$90^o – 0^o – 90^o$	$90^o – 0^o – 90^o$	$90^o – 0^o – 90^o$	$90^o – 0^o – 90^o$

Table 11- Initial Range of motion of radioulnar joint.

WRIST JOINT				
Plane	**Left side**		**Right side**	
	Active Movement	**Passive Movement**	**Active Movement**	**Passive Movement**
S	$60^o – 0^o – 50^o$	$80^o – 0^o – 80^o$	$35^o – 0^o – 80^o$	$70^o – 0^o – 90^o$

Table 12- Initial Range of motion of wrist joint .

3.3.12. Joint play examination by Lewit

I examined the Joint play of the following joints listed at the table below:

Upper extremity		
Joint	**Left**	**Right**
Shoulder Joint (all directions)	Not Restricted	Restricted in Dorsal Direction
Scapula	Restricted in all directions	Restricted in all directions
Acromioclavicular Joint	Restricted in cranio-caudal direction	Restricted in cranio-caudal direction
Sternoclavicular Joint	Not Restricted	Not Restricted
Elbow Joint	Not Restricted	Not Restricted
Radiocarpal Joint	Not Restricted	Restricted in Dorsal Direction
Carpometacarpal Joint	Not Restricted	Restricted in Palmar Direction
Carpal Bones	Not Restricted	Capitate restricted in dorsal Direction
Carpometacarpal Joint of the thumb	Not Restricted	Not Restricted
Metacarpophalangeal Joints	Not Restricted	Not Restricted
Interphalangeal Joints	Not Restricted	Not Restricted

Table 13- Initial Examination of Joint Play by Lewit in Upper Extremity.

Lower extremity		
Joint	**Left**	**Right**
Sacroiliac joint	Not Restricted	Restricted
Patella	Not Restricted	Restricted in caudal Direction
Knee joint	Not Restricted	Not Restricted
Tibiofibular joint	Restricted in ventral and dorsal directions	Restricted in ventral and dorsal directions
Talocrural joint	Not Restricted	Not Restricted
Subtalar joint	Not Restricted	Not Restricted
Talocalcaneonavicular joint	Not Restricted	Not Restricted
Lisfranc's joint	Not Restricted	Restricted in dorsal and ventral direction
Chopart's joint	Not Restricted	Restricted in dorsal and ventral direction
Metatarsophalangeal Joints	Not Restricted	Not Restricted
Interphalangeal Joints	Not Restricted	Not Restricted

Table 14- Initial Examination of Joint Play by Lewit in Lower Extremity.

3.3.13 Neurological examination

Examination of Cranial Nerves

Cranial nerve	Outcome
I. Olfactory	Physiological
II. Optic	Physiological
III. Oculomotor	Physiological
IV. Trochlear	Physiological

V. Trigeminal	Physiological
VI. Abducens	Physiological
VII. Facialis	Possible Pathological Sign*
VIII. Vestibulocochlear	Possible Pathological Sign**
IX. Glossopharyngeal	Physiological
X. Vagus	Physiological
XI. Accessory	Physiological
XII. Hypoglossal	Physiological

Table 15- Initial Examination of Cranial Nerves.

*The patient could provide most of the facial expressions, like smiling when he was asked to, while we had a non specific examination for the facial nerve by asking the patient to provide various facial expressions we did not provide muscle strength test for the facial muscles. Although when he was asked to puff out his cheeks he was not able to do it. Also the patient was not able to swipe his lips together when he was asked for it. This is not a necessarily pathological sign put it should be noted. As noted already on the observation segment of the initial examination the face of the patient looks symmetrical.

**The patient had impaired hearing in the right ear. Although it is important to underline that the patient had a rapture of his tympanic membrane when he was younger (as already mentioned in the anamnesis) and he has suffered hearing loss since then. So the finding is probably caused by that and not by an impaired Vestibulocochlear nerve but since we cannot be 100 % sure it should be noted.

Examination of Superficial Sensation

I examined the superficial sensation by applying light touch in various dermatomes of patient's body in both sides of his body. The results of the examination are listed in the following table:

Dermatome	Left Side	Right Side
C5	Physiological	Physiological
C6	Physiological	Physiological
C7	Physiological	Physiological
C8	Physiological	Physiological
T1	Physiological	Physiological
T2	Physiological	Physiological
T3	Physiological	Physiological
L2	Physiological	Physiological
L3	Physiological	Physiological
L4	Physiological	Hyposensitivity appears
L5	Physiological	Hyposensitivity appears
S1	Physiological	Hyposensitivity appears
S2	Physiological	Normal

Table 16- Initial Examination of Superficial Sensation.

Examination of Deep Tendon Reflexes

I completed this examination using a standard neurological hammer. The following grading system was used to measure the results: 0 -Absent Reflex, 1-Hypoactive Reflex or present only reinforcement, 2-Readily Elicided with a normal response, 3-Brisk Reflex with or without evidence of spread to the neighboring roots, 4-Unsustained Clonus, 5-Substained clonus. The results are listed in the following table:

Segment	Grade Left Side	Grade Right Side
Biceps, C5-C6	3	3
Triceps, C7	3	4
Brachioradialis, C5-C6	3	3
Flexors, C8	2	4
Patellar, L2-L4	4	4
Achilles, L5-S2	2	2

Table 17- Initial Examination of Deep Tendon Reflexes.

Examination of Deep Sensation

In order to examine the deep sensation we tested kinesthesia and discrimination (graphesthesia, stereognosia, two-point discrimination)

Kinesthesia: We are examining the position sense of the patient by moving his big toe up and down and ask the patient to declare in which position his big toe is. I started the examination by moving the big toe up and down, the first few times I asked the patient in which position I moved his big he was unconsciously opening his eyes in order to see in which position the toe was. When I asked him to keep his eyes closed he was unable to say if his big toe was placed up or down and moreover the patient could not feel if his big toe was moving or was still when I was moving it. Since the move of the big toe was impaired I continued with the ankle. Again when I moved his foot and asked the patient to tell me in which position the ankle was he unconsciously opened his eyes in order to see where I had moved his foot. The patient was unable to sense the position of the ankle joint and he was also unable to sense the movements as well. With ankle being impaired I continued with the knee and the hip which were physiological, the patient could discriminate the position of the joint as well the direction of the movement. I continued with the upper extremity where the movement of the fingers and the wrist were impaired with the patient being unable to sense the position and the movement of the joint. The patient had a physiological response when the elbow and the shoulder joint were examined.

Graphesthesia: While the patient kept his eyes closedWith the tip of a pen I draw the number 7 in his palm and I asked him to identify it. The patient was unable to identify it.

Stereognosis: I place a pen in the patients hand while he eyes was closed and asked him to identify what object I gave him. He was able to do it.

Two-Point Discrimination: With a paper clip which was modified to have two sharp edges I alternatively touched the patient with one sharp edge and with both sharp edges and I asked the patient to identify if he was touch by one or two edges. The patient could not discriminate it in his fingers, wrist and up the middle forearm in his upper extremity and in his toes, foot and ankle and up until the calf in the lower extremity.

Examination of Cerebellar Signs

Finger to nose test : The patient was asked to alternatively touch the tip of my index finger and his nose. The patient was able to perform the test in a moderate speed he was not 100% precise with his right arm when it comes to touching the tip of my index finger but he did not miss the finger so the test was declared negative.

Test of rapid Alternative Movements: The patient was asked to clasp his palms while he was pronating and supinating his forearms. The patient was able to perform it without absolute precision.

Test for dysrhrythmia: The patient was asked to tap his palm in his thigh in a steady rhythm or temp. The patient was able to perform the test.

Knee to heel test: The test was positive.

Examination of Primitive Reflexes

The results of the examination are listed in the following table:

Reflex	Outcome
Palmomental Reflex	Negative
Palmar Grasp Reflex	Negative
Glabellar tap Reflex	Positive

Table 18- Initial Examination of Primitive Reflexes.

Examination of Pathological Reflexes- Pyramidal Signs

Examination of Spastic (irritative) Signs

Spastic Sign	Outcome
Upper Extremity	
Juster's Sign	Negative
Trommner Sign	Negative
Hoffman's Sign	Negative
Lower Extremity	
Babinski´s sign	Negative

Vítek´s summed sign	Negative
Roche´s sign	Negative
Oppenheim’s Sing	Negative
Siccard’s sign	Negative
Mendel-Bechterev’s Sing	Negative
ZukovskiJ-Kornilov’s Sign	Negative
Rossolimo’s Sign	Negative

Table 19- Initial Examination Of Spastic (irritative) Signs.

Examination of Paretic Signs

*Before having the examination for the paretic signs I asked the patient if his things that the one side of his body is more affected after the stroke than the other. Interestingly enough the patient answered no. As we see below all the paretic signs are positive with the right side being affected.

Paretic Sign	**Outcome**
Upper Extremity	
Mingazzini	Positive
Dufour	Positive
Barré	Positive
Hanzal	Positive
Rusedskij	Positive
Lower Extremity	
Mingazzini	Positive
Barré I	Positive
Barré II	Positive
Barré III	Positive

Table 20- Initial Examination of Paretic Signs.

3.3.14 Examination of ADL and Functional assessments

Examination of ADL (Activities of Daily Living):

I examined and reviewed the ability of the patient to perform the following activities of daily living:

- **Ability to eat/drink:** The patient is able to feed himself, he is mostly using his unaffected upper extremity to use a spoon for example or to grab a bottle of water and drink it. I will underline that although he is able to feed himself he is doing it quite slowly in a comparison with a healthy Person.
- **Ability to dress:** The patient is not able to dress himself independently he needs assistance from a nurse to do so.
- **Ability to undress:** The patient is not able to undress himself independently he needs assistance from a nurse to do so.
- **Ability to transfer himself:** The patient is not able to transfer himself , on the first day at the hospital he was moved to take a bath by a wheelchair.
- **Ability to use the toilet:** The patient is not able to use the toilet by himself. A catheter has been inserted in his urethra and he is wearing a diaper.
- **Ability to wash/bath:** The patient is not able to wash himself. He needs assistance by the nurse. He also needs a wheelchair to be transferred n order to get a bath or get washed.
- **Ability to write**: The patient was able to write a word using his right, affected upper extremity with difficulty. It was possible to distinguish what he wrote although his graphic character was lacking quality and appeared trembling.
- **Ability to use his cell phone:** The patient is regularly calling his wife and son or receives calls from them so I tried to examine his ability to do so. The patient is able to text a number in a quite slow speed though.
- **Moving from the bed (from lying to sitting and vise/versa, rolling from one side of the bed to the other):**The patient uses a horizontal bar hanging above his bed to lift his self in order to go to a sitting position although he needs some assistance because he has difficulty to rotate himself by using his lower extremity. So it is possible for him to curl up using the horizontal bar but at that he needed some assistance to go to sitting. From sitting to lying was same he needed assistance to rotate and get parallel to the bed and then he was able to lay down by himself. The patient had great difficulty to roll from one side of the bed to other and he was able to do it only with assistance. Moving from right side of the bed to left was the most difficult for him.

Examination of functional assessments

I used some functional tests expect the ADL examination in order to further review patient's independence and abilities like his balance. The tests I used are the following accompanied by their outcomes:

- **Functional Reach Test:** This test usually takes place in standing position but the patient performed it in sitting due to his inability to stand alone. The patient was asked to reach with stretched arm to grab a bottle of water while I was away from him. The patient was able to grab the bottle with his left hand but when he tried to used his right arm when he tried to extend it and stretch t I had to lower the bottle and bring it closer to him in order to grab it since his right upper extremity started "falling" and generally the patient started to lose his balance.
- **From Sitting to Standing Test:** The patient was only able to perform the test with assistance and with difficulty.
- **From Standing to Sitting:** The patient was only able to perform the test with assistance and with difficulty.
- **Pick up an object from the floor:** The patient was able to perform the test from sitting position but with great difficulty especially when he tried it with his right upper extremity.
- **Turning to look behind over both shoulders:** The patient was able to perform the test.
- **Get up and Go test:** The patient was not able to perform the test.

3.3.15 Conclusion of examination

Only three weeks after the cerebrovascular accident occurred, as expected the patient appears to be facing the residues of that episode in a sub-acute form. The Physical disabilities are prominent but justified since the patient is still in the sub-acute phase after the stroke and moreover as I was informed, until now the rehabilitation was mainly focused on prevention of secondary complications and not on improving the actual condition of the patient. As far as cognition goes, in my opinion the patient is in quite good condition while of course taking in consideration the diagnosis. A brief review of the outcomes of each one of the initial examinations that are listed above will further enlighten the conclusion and help to summarize it. During observing and speaking with the patient, signs of mild aphasia were detected. Also after completing the examination

of the higher functions of the patient we obserced some mild positive signs of impaired cognition but nothing too significant. It was easily distinguishable that the right side of the patient was the affected one from just observing him. The posture of the patient was heavily influenced by the use of an assistive device so we can call the outcome plasmatic although it is apparent that the patient could not stand by himself except he had assistance and that is what we have to underline here. The gait is pretty much absent but during the brief examination we should be underlining the absolute non-weight bearing of the right lower extremity and its passive attitude during the attempt for walk. The breathing examination showed that the patient is not properly using the abdominal muscles with his breathing pattern. After the anthropometric measurements of the lower extremities the results testify a slightly less trophic right lower extremity. As far as the soft tissue examination the main finding was the restriction of the fascias of the anterior part of the thigh and around the calf. Continuing with the examination of muscle tone and spasticity the majority of the muscles and especially the ones of lower extremity are hypotonic (during palpation I distinguished a lower tone of the right LE while the left one was still hypotonic) although a slight hypertonicity was detected in the flexors of the forearm and the wrist as well as the pronator teres. The modified Asworth Scale for spasticity did not show positive signs although an increase of tone was observed during rapid passive extension of wrist and fingers but I would not say that the patient has developed spasticity yet since flaccidity and hypotonicity are present in the majority of muscles and also all of the tests for spasticity appeared negative during the neurological examination. The R.O.M examination confirmed the limitation of range of motion in almost all joints that we had already aspect. There is limitation in all joints and in some cases the limitation appears greater in the right side. As we can see in the tables of the examinations in the majority of the movements the R.O.M of the passive movements is greater than the active ones which suggests that the muscle group associated could be weak or impaired. Except the limitation of the R.O.M., the joint play of several joints (both in UE and LE) was declared restricted after the respective examination which is further contributing in the limited R.O.M. After a variety of neurological examinations which can be reviewed in great detail in the tables above the main conclusion is that the right side is affected and that all the paretic signs appeared positive (according the right side of the body) and that all the spastic signs appeared negative. Also a finding to be underlined is the impaired deep sensation of the patient in which was the outcome of the deep sensation examination. Other findings further confirmed the diagnosis of stroke

which is a central lesion. Sensory and motor deficits were confirmed after the neurological examination. Last but not least, and in my opinion the most important examination in this case was the testing of ADL and functionality of the patient. After completing a series of tests it was pretty apparent that the patient is really confined and dependent for simple activities of daily living. The patient cannot be transferred by himself and he needs assistance for most of his needs that most people are taking for granted. In conclusion, I think that every result of the examination, general or specific will help us construct and set the goals for a rehabilitation plan appropriate for the patient that will help him regain a large percentage of his dependency and in extension insure a higher quality life for him.

3.4 Short and long-term rehabilitation plan

3.4.1 Short-term Rehabilitation Plan

- Verticalization
- Facilitate the impaired muscles
- Increase Range Of Motion
- Improve Breathing Pattern
- Restore the Restricted Joint Play
- Release the Restricted Fascias
- Prevent the unawareness of The Paretic Side
- Facilitate weight bearing of The Paretic Side
- Improve Balance
- Improve coordination of active movements
- Prevent the Development of Spasticity
- Restore the Ability To Walk
- Improve Functionality of The Patient

3.4.2 Long-term Rehabilitation Plan

- Maintain and Improve the achievements of Short-term Rehabilitation Plan
- Improve Posture
- Improve Gait
- Restore The Ability to do basic ADL
- Prevent Any Possible Contracture or Deformity
- Achieve highest possible physical security for the Patient
- Restore Independence for the patient

3.5 Therapy Progress

*Patient therapy program goes as: After he wakes up around 9 a.m. he is having a physiotherapeutic session with me which lasts around 1 hour. Around 75 minutes after finishing the physiotherapeutic session the patient is having an ergotherapy session at the ergotherapy ambulance of the hospital where he is practicing ADL. Also after I leave the hospital during the afternoon after he is having 20-25 minutes of motorbike (Reck Motomed letto2) actively as a self therapy in supine or sitting position in the last days of the rehabilitation.

*All the therapies where applied to both sides of the body expect were noted. Emphasis was given to the right, affected side of the body though.

Therapy Session 1, Date: 21/01/2016

Status Presents

- Today is my first physiotherapeutic session with the patient.
- The patient seems fatigued since we completed a long set of examination before the therapeutic session.
- The patient does not seem in a very good mood since he is Fatigued.
- Before we started our therapy session a nurse came and took a history record of the patient, but the patient was a little bit confused so the nurse decided to take the record at some other point.
- **Blood pressure:** 120/70mmHg
- **Heart pulse:** 74/minute
- **Body Temperature:** 36, 2 C^{o}

Plan of Today's Therapy and Therapy Proposal

- Improve Breathing Pattern by using breathing exercises.
- Release Restricted Fascias of the lower extremity using soft tissue techniques.
- Mobilize the joints of upper and lower extremity which appear with restricted Joint Play.
- Facilitate the muscles of lower extremity by using strengthening and conditional exercises that focus on large muscle groups (in this case quadriceps and hamstrings).
- Facilitate Dorsal Flexion of the right foot.
- Electro-gymnastics for facilitation of quadriceps femoris.

- Increase the range of motion of the lower extremity by stretching the triceps surae and the hamstring muscles (indicated by my supervisor).

Procedure

- We started with breathing exercising in lying position with knees flexed by touching the patient's abdominal wall we asked him to concentrate his breathing the abdomen area in order to activate and facilitate intra abdominal breathing.
- We continued with Soft tissue techniques according to Lewit, firstly in cranio-caudal direction in ventral part of right thigh fascia and then we continued with the left thigh repeating the same procedure. The patient was in supine line with his knees extended. More over we continued with soft tissue techniques according to Lewit, this time in latero-lateral direction in the dorsal part of right and left calf fascias, the patient was in supine line with his knees flexed.
- While the patient being in sitting position we mobilized the shoulder of the patient using springing technique in dorsal direction repeating the springing for 30 times according Joint Play by Lewit.
- In supine lying we mobilized the Acromioclavicular Joint of the patient in cranial and caudal direction according Joint Play by Lewit.
- In prone lying we mobilized patient's Right scapula in clockwise and anticlockwise directions according Joint Play by Lewit. Then we repeated the same procedure for the left scapula.
- In sitting position we mobilized patient's Right radiocarpa joint in dorsal direction Joint by using springing technique repeated for 30 times according Joint Play by Lewit.
- In sitting position we mobilized patient's Right Carpometacarpal joint in palmar direction Joint by using springing technique repeated for 30 times according Joint Play by Lewit.
- In sitting position we provided traction technique in order to mobilize patient's capitate carpal bone, we repeated the maneuver for 2 times, according Joint Play by Lewit.
- In lying position with left lower extremity extended and right hip adducted and knee flexed we mobilized the sacroiliac joint in dorsal direction from the right side. We used springing technique for 30 times, According Joint Play by Lewit.

- In lying position, the patient had flexed his right knee and while I was sitting on his right foot I mobilized his head of fibula in ventral and dorsal direction by springing technique it 30 times in each direction, according Joint Play by Lewit.
- In lying position I mobilized his patella of patient's right knee in caudal direction, using springing technique repeated for 30 times according Joint Play By lewit.
- In lying position I mobilized patient's Lisfranc's Joint of the foot in dorsal and ventral direction, using springing technique for 30 times in each direction according Joint Play by Lewit.
- In lying position I mobilized patient's Chopart's Joint of the foot in dorsal and ventral direction, using springing technique for 30 times in each direction according Joint Play by Lewit.
- We continued with an exercise for facilitation of the right quadriceps, while the patient was in lying position, we placed a semi-inflated over ball under patient's popliteal fossa of knee and asked him to press down the ball in order to stimulate extension of the knee Joint. 3 sets of 10 repetitions.
- In Lying position we placed a semi-inflated over ball under patient's right heel of his extended lower extremity and we asked him to use the ball as lever in order to roll it in cranial direction while flexing his knee and hip Joints and then rolling it back down to caudal direction while extending both joints. 3 sets of ten repetitions.
- In lying position and while placing his knee in extension and his hip in flexion we stretched patients triceps surae passively by dorsiflexing the foot and keeping it in this position for 30 seconds. Repeated 3 times. Provided in both LE (Both LE's).
- We used electro-gymnastics for facilitation of quadriceps femoris (right LE), Intensity: 40mA, Frequency: 50Hz, Impulse: 300ms, Stimulation of contraction: 5s, Pause: 25s. We asked the patient to actively contract his quadriceps isometrically during the 5 seconds of the contraction.
- The patient was in lying position with hip and knee flexed, we asked the patient to try to achieve dorsal flexion, it was impossible for him, and we asked him to constantly maintain eye contact with his foot in order to facilitate the movement with the help of visual stimuli.
- In lying position while making sure that we kept patient's right knee extended we stretched patients hamstrings passively and holding to the flexed hip-extended knee position for about 30 seconds. Repeated 3 times. Provided in Both LE.

Subjective Result

The patient admitted he was really fatigued after the end of today's therapeutic procedure even though it was not long, although we can justify his fatigue due to his condition and also the fact that we also provided a wide series of different examinations today.

Objective Result

The patient had difficulty adapting to the active attitude of today's therapy. The patient had issues understanding some of the exercises and he faced great difficulty to execute the exercises that required active use of his affected, right lower extremity. For example when we asked the patient to perform contraction of the quadriceps while having an overball under his knee cap, he kept performing flexion moving his popliteal line away from the overball doing exactly the opposite that I was asking him which was to press the popliteal line against the ball in order to provoke extension. After the first therapy session it became even more obvious that in order to achieve a proper verticalization and in an extension provoke walking and regain the ability to do basic ADL activities we have to facilitate the paretic right side (especially the lower extremity) and make the patient aware of it.

Therapy Session 2, Date: 22/01/2016

Status Presents

- Today is my second physiotherapeutic session with the patient.
- Once I arrived at my patient's room at around 9 a.m. the patient was still sleeping.
- Once I woke him up he seemed tired and confused although he quickly regained his awareness, I asked him if he wanted to have the therapy later this day but he insisted to start the therapy immediately.
- The patient had a slight edema just above his medial maleolus and my supervisor called the Doctor who was on duty at the time to check it before we had any therapy. The doctor said that it looked like a minor trauma but the patient did not have any recollection of getting it. The doctor ensured me that there should not be any contraindication because of it since it was really minor and insignificant.
- **Blood pressure:** 140/90mmHg
- **Heart pulse:** 80/minute
- **Body Temperature:** 36, 5 C^{o}

Plan Of Today's Therapy And Therapy Proposal

- Improve Breathing Pattern by using breathing exercises.
- Release Restricted Fascias of the lower extremity using soft tissue techniques.
- Verticalize the patient and try to instruct him how to transfer himself from lying to sitting and from sitting to standing and then try to take a few steps using the high walker.
- Mobilize and facilitate shoulder girdle movements by applying exercises in lying position and also using the fundamentals of First Diagonal Flexion Pattern according to P.N.F.
- Mobilize the joints of upper extremity which appear with restricted Joint Play.
- Increase the range of motion of the wrist joint and try to prevent the developing spastic pattern by using passive stretching of the wrist and fingers into extension.
- Mobilize the pelvis and facilitate postural patterns by applying bridging exercise according Fredericson and Moore and a modification of it.
- Mobilize the joints of lower extremity which appear with restricted Joint Play.
- Facilitate the muscles of lower extremity by using strengthening and conditional exercises that focus on large muscle groups (in this case quadriceps and hamstrings).
- Increase the range of motion of the lower extremity by stretching the triceps surae and the hamstring muscles (indicated by my supervisor).

Procedure

- We started with breathing exercising in lying position with knees flexed by touching the patient's abdominal wall we asked him to concentrate his breathing the abdomen area in order to activate and facilitate intra abdominal breathing.
- We continued with Soft tissue techniques according to Lewit, firtstly in cranio-caudal direction in ventral part of right thigh fascia and then we continued with the left thigh repeating the same procedure. The patient was in supine line with his knees extended. More over we continued with soft tissue techniques according to Lewit, this time in latero-lateral direction in the dorsal part of right and left calf fascias, The patient was in supine lying with his knees flexed.
- We continued with Verticalization of the patient. First we instructed him how to transfer from lying to sitting position-by turning to affected side and going to sitting using his unaffected side and from sitting to standing where he needed assistance by

me, I supported his unaffected LE. Also trying to instruct him how to properly use his high walker, also to try to incorporate some weight bearing to his right, affected lower extremity and how to use visual stimuli in order to achieve actual steps and move forward.

- In supine lying position while having patient's shoulder flex in 90 degrees and his elbow extended we passively protracted and retracted the scapula and then we asked the patient to actively repeat the movement.
- We continued with applying passively the first diagonal flexion and extension patterns for the shoulder joint according P.N.F. Then we continued by asking the patient to repeat the diagonals actively.
- While the patient was lying in supine position we asked him to actively flex his shoulders at 90 degrees while keeping elbows extended and try to hold his arms in space while focusing on the affected, right upper extremity and try to prevent it from deviating from that position as much as possible.
- While the patient being in sitting position we mobilized the shoulder of the patient using springing technique in dorsal direction repeating the springing for 30 times according Joint Play by Lewit.
- In supine lying we mobilized the Acromioclavicular Joint of the patient in cranial and caudal direction according Joint Play by Lewit.
- In prone Line we mobilized patient's Right scapula in clockwise and anticlockwise directions according Joint Play by Lewit. Then we repeated the same procedure for the left scapula.
- In sitting position we mobilized patient's Right radiocarpal Joint in dorsal direction by using springing technique repeated for 30 times according Joint Play by Lewit.
- In sitting position we mobilized patient's Right Carpometacarpal Joint in palmar direction by using springing technique repeated for 30 times according Joint Play by Lewit.
- In sitting position we provided traction technique in order to mobilize patient's capitate carpal bone, we repeated the maneuver for 2 times, according Joint Play by Lewit.
- In sitting position we passively stretched the wrist flexors by stretching passively the wrist and the fingers of the right upper extremity into extension and held it for 30 seconds. Repeated for 3 times.
- In supine lying position we instruct the patient how to provide the bridging exercise

with his knees flexed. We used an over ball between patient's knees. We divided the exercise in two parts in order for the patient to better understand the components of the exercise. We first started by asking the patient to make a "small" bridge by just providing a posterior tilt of the pelvis and then to progress it into a "big" bridge by lifting upwards his pelvis while I was fixing his affected, unstable, right lower extremity and also assisting with the pelvis elevation. The patient stayed in that elevated position for approximately 5 seconds and then he returned to the starting position. Repeated for 10 times.

- In lying position, the patient had flexed his right knee and while I was sitting on his right foot I mobilized his head of fibula in ventral and dorsal direction by springing technique it 30 times in each direction, according Joint Play by Lewit.
- In lying position I mobilized his patella of patient's right knee in caudal direction, using springing technique repeated for 30 times according Joint Play By lewit.
- In lying position I mobilized patient's Lisfranc's Joint of the foot in dorsal and ventral direction, using springing technique for 30 times in each direction according Joint Play by Lewit.
- In lying position I mobilized patient's Chopart's Joint of the foot in dorsal and ventral direction, using springing technique for 30 times in each direction according Joint Play by Lewit.
- We continued with an exercise for facilitation of the right quadriceps, while the patient was in lying position, we placed a semi-inflated over ball under patient's popliteal fossa of knee and asked him to press down the ball in order to stimulate extension of the knee Joint. 3 sets of 10 repetitions.
- In Lying position we placed a semi-inflated over ball under patient's right heel of his extended lower extremity and we asked him to use the ball as lever in order to roll it in cranial direction while flexing his knee and hip Joints and then rolling it back down to caudal direction while extending both joints. 3 sets of ten repetitions.
- In lying position and while placing his knee in extension and his hip in flexion we stretched patients triceps surae passively by dorsiflexing the foot and keeping it in this position for 30 seconds. Repeated 3 times. Provided in both LE.
- In lying position while making sure that we kept patient's right knee extended we stretched patients hamstrings passively and holding to the flexed hip-extended knee position for about 30 seconds. Repeated 3 times. Provided in Both LE.

Subjective Result

The patient said he was exhausted during the final quarter of the exercise circle and he asked nicely if it was possible to stop in order for him to rest. Also the patient complained that the prone lying is not really comfortable for him and in extension I decided to modify the mobilization of scapula from prone lying to side lying since this is the only therapeutic procedure we are applying in prone position

Objective Result

The patient begun today's session in a much better state, and in a good mood in a comparison with our first session, although he got fatigued quickly. Again he had a difficulty understanding and performing the active exercises and when we are instructing him to perform a movement or a complex pattern he needs a little time to understand and execute the directions of the movement. When performing active movements with his right LE there is a tendency for the right LE to fall laterally so it requires some stabilization from me.

Therapy Session 3, Date: 25/01/2016

Status Presents

- Today is my third physiotherapeutic session with the patient.
- The patient was sleeping when I arrived at his room at around 8:45 am and in order to leave him more time to rest I worked with another patient and once I got back to my patient was awake
- The patient told me that he got tired during the previous session but he was in good mood today.
- My supervisor informed me that the Neurologist and also the Ergotherapist of the hospital diagnosed the patient with neglect syndrome and apraxia. The rehabilitation plan that the patient is following can work against those findings though especially when emphasizing to the affected, right LE.
- The slight trauma which appeared in patient's foot during the previous session was not present any more so it was indeed something insignificant as the doctor said.
- **Blood pressure:** 110/60mmHg
- **Heart pulse:** 72/minute
- **Body Temperature:** 36, 2 C^{o}

Plan of Today's Therapy And Therapy Proposal

- Consult with the patient and in order to motivate him and make him understand that this rehabilitation program has the goal to make his life as normal as possible, to make him walk and to be independent again.
- Release Restricted Fascias of the lower extremity using soft tissue techniques.
- Verticalize the patient, try to instruct him to increase the weight bearing of the affected, right lower extremity.
- Mobilize and facilitate shoulder girdle movements by applying exercises in lying position and also using the fundamentals of First Diagonal Flexion Pattern according to P.N.F.
- Mobilize the joints of upper which appear with restricted Joint Play.
- Increase the range of motion of the wrist joint and try to prevent the developing spastic pattern by using passive stretching of the wrist and fingers into extension.
- Exercising in sitting position which will facilitate the upper right extremity by transmitting the weight of the body to it.
- Mobilize the pelvis and facilitate postural patterns by applying bridging exercise according Fredericson and Moore and a modification of it.
- Mobilize the joints of lower extremity which appear with restricted Joint Play.
- Facilitate the muscles of lower extremity by using strengthening and conditional exercises that focus on large muscle groups (in this case quadriceps and hamstrings)
- Use electro-gymnastics in order to facilitate of the quadriceps femoris by provoking contractions.
- Increase the range of motion of the lower extremity by stretching the triceps surae and the hamstring muscles (indicated by my supervisor)
- Mobilize the joints of upper and lower extremity which appear with restricted Joint Play.

Procedure

- We started with Soft tissue techniques according to Lewit, firtstly in cranio-caudal direction in ventral part of right thigh fascia and then we continued with the left thigh repeating the same procedure. The patient was in supine line with his knees extended. More over we continued with soft tissue techniques according to Lewit, this time in latero-lateral direction in the dorsal part of right and left calf fascias, the

patient was in supine lying with his knees flexed.

- We continued with Verticalization of the patient. First we instructed him how to transfer from lying to sitting position-by turning to affected side and going to sitting using his unaffected side and from sitting to standing where he needed assistance by me, I supported his unaffected LE. Also trying to instruct him how to properly use his high walker, also to try to incorporate some weight bearing to his right, affected lower extremity and how to use visual stimuli in order to achieve actual steps and move forward.
- In supine lying position while having patient's shoulder flexed in 90 degrees and his elbow extended we passively protracted and retracted the scapula and then we asked the patient to actively repeat the movement.
- We continued with applying passively the first diagonal flexion and extension patterns for the shoulder joint according P.N.F. Then we continued by asking the patient to repeat the diagonals actively.
- While the patient was lying in supine position we asked him to actively flex his shoulders at 90 degrees while keeping elbows extended and try to hold his arms in space while focusing on the affected, right upper extremity and try to prevent it from deviating from that position as much as possible.
- While the patient being in sitting position we mobilized the shoulder of the patient using springing technique in dorsal direction repeating the springing for 30 times according Joint Play by Lewit.
- In supine lying we mobilized the Acromioclavicular Joint of the patient using in cranial and caudal direction according Joint Play by Lewit.
- In side lying we mobilized patient's Right scapula in clockwise and anticlockwise directions according Joint Play by Lewit. Then we repeated the same procedure for the left scapula.
- In sitting position we mobilized patient's Right Radiocarpal Joint in dorsal direction by using springing technique repeated for 30 times according Joint Play by Lewit.
- In sitting position we mobilized patient's Right Carpometacarpal Joint in palmar direction by using springing technique repeated for 30 times according Joint Play by Lewit.
- In sitting position we provided traction technique in order to mobilize patient's capitate carpal bone, we repeated the maneuver for 2 times, according Joint Play by Lewit.

- In sitting position we passively stretched the wrist flexors by stretching passively the wrist and the fingers of the right upper extremity into extension and held it for 30 seconds. Repeated for 3 times.
- We instructed the patient to be in sitting position and try to transmit his weight laterally toward the affected, right side and to use his right upper extremity to support his self and bear his weight.
- In supine lying position we instruct the patient how to provide the bridging exercise with his knees flexed. Today we did not use any over ball between patient's knees. We divided the exercise in two parts in order for the patient to better understand the components of the exercise. We first started by asking the patient to make a "small" bridge by just providing a posterior tilt of the pelvis and then to progress it into a "big" bridge by lifting upwards his pelvis while I was fixing his affected, unstable, right lower extremity and also assisting with the pelvis elevation. The patient stayed in that elevated position for approximately 5 seconds and then he returned to the starting position. Repeated for 10 times.
- In lying position, the patient had flexed his right knee and while I was sitting on his right foot I mobilized his head of fibula in ventral and dorsal direction by springing technique it 30 times in each direction, according Joint Play by Lewit.
- In lying position I mobilized his patella of patient's right knee in caudal direction, using springing technique repeated for 30 times according Joint Play By lewit.
- In lying position I mobilized patient's Lisfranc's Joint of the foot in dorsal and ventral direction, using springing technique for 30 times in each direction according Joint Play by Lewit.
- In lying position I mobilized patient's Chopart's Joint of the foot in dorsal and ventral direction, using springing technique for 30 times in each direction according Joint Play by Lewit.
- We continued with an exercise for facilitation of the right quadriceps, while the patient was in lying position, We placed a semi-inflated over ball under patient's popliteal fossa of knee and asked him to press down the ball in order to stimulate extension of the knee Joint, I was also "itching" the surface of patient's quadriceps in order to further stimulate the muscle and facilitate the movement. 3 sets of 10 repetitions.
- In Lying position we placed a semi-inflated over ball under patient's right heel of his extended lower extremity and we asked him to use the ball as lever in order to roll it

in cranial direction while flexing his knee and hip Joints and then rolling it back down to caudal direction while extending both joints. 3 sets of ten repetitions.

- In lying position and while placing his knee in extension and his hip in flexion we stretched patients triceps surrae passively by dorsiflexing the foot and keeping it in this position for 30 seconds. Repeated 3 times. Provided in both LE.
- We used electro-gymnastics for facilitation of quadriceps femoris, Intensity: 38mA, Frequency: 50Hz, Impulse: 300ms, Stimulation of contraction: 5s, Pause: 25s. We asked the patient to actively contract his quadriceps isometrically during the 5 seconds of the contraction period.
- In lying position while making sure that we kept patient's right knee extended we stretched patients hamstrings passively and holding to the flexed hip-extended knee position for about 30 seconds. Repeated 3 times. Provided in Both LE.

Subjective Result

Although the patient said that once again he felt weak after the session he also admitted that he can feel a little more active and he can see a slight improvement of his physical condition.

Objective Result

The patient had difficulty to adapting to the new exercises I introduced him today since they were a little complex but I could see an improvement on him compared to the first and second days. One positive note is that even without measuring it, it is obvious that the R.O.M of the lower extremity, especially in the hip flexion has been increased. Also the patient seems to have become more aware of his affected side, mostly in the upper extremity. Also the following Joints are not restricted any more in neither side as far as Joint Play goes: Acromiclavicular Joint, Radiocarpal Joint, Carpometacarpal Jount, Capitate Carpal Bone, Patella . Last but not least I think that he is more determined and motivated to work hard and get better.

Therapy Session 4, Date: 26/01/2016

Status Presents

- Today is my fourth physiotherapeutic session with the patient.
- The patient seemed in a good mood even though he had just woken up.
- The patient is now one month after he had the stroke.
- My supervisor informed that the patient did some active and passive exercises during the weekend with the physiotherapist who was in duty and did 20 minutes of motorbike on Sunday and Saturday.
- **Blood pressure:** 140/80mmHg
- **Heart pulse:** 75/minute
- **Body Temperature:** 36, 2 C^{o}

Plan Of Today's Therapy And Therapy Proposal

- Release Restricted Fascias
- Verticalize the patient, try to instruct him to increase the weight bearing of the affected, right lower extremity.
- Mobilize and facilitate shoulder girdle movements by applying exercises in lying position and also using the fundamentals of First Diagonal Flexion Pattern according to P.N.F.
- P.N.F. for right and left scapula in both directions
- Increase the range of motion of the wrist joint and try to prevent the developing spastic pattern by using passive stretching of the wrist and fingers into extension. Also instruct the patient to practice active supination.
- Exercising in sitting position which will facilitate the upper right extremity by transmitting the weight of the body to it. Also adding a modified version of the exercises in order to facilitate balance as well.
- Balance exercises in sitting position.
- Mobilize the pelvis and facilitate postural patterns by applying bridging exercise and according Fredericson and Moore and a modification of it.
- Facilitate the muscles of lower extremity by using strengthening and conditional exercises that focus on large muscle groups (in this case quadriceps, hip adductors and hamstrings).
- Increase the range of motion of the lower extremity by stretching the triceps surae and the hamstring muscles (indicated by my supervisor).

Procedure

- We started with Soft tissue techniques according to Lewit, firtstly in cranio-caudal direction in ventral part of right thigh fascia and then we continued with the left thigh repeating the same procedure. The patient was in supine line with his knees extended. More over we continued with soft tissue techniques according to Lewit, this time in latero-lateral direction in the dorsal part of right and left calf fascias, The patient was in supine lying with his knees flexed.
- We continued with Verticalization of the patient. First we instructed him how to transfer from lying to sitting position-by turning to affected side and going to sitting using his unaffected side and from sitting to standing where he needed assistance by me, I supported his unaffected LE. Also trying to instruct him how to properly use his high walker, also to try to incorporate some weight bearing to his right, affected lower extremity and how to use visual stimuli in order to achieve actual steps and move forward. Also try to make patient aware of a correct walking stereotype which includes swing and stance phase and the components like heel strike, mid stance and toes off and asked him to be constantly conscious about it even if he is not able to physically perform them
- In supine lying position while having patient's shoulder flexed in 90 degrees and his elbow extended we passively protracted and retracted the scapula and then we asked the patient to actively repeat the movement.
- We continued with applying passively the first diagonal flexion and extension patterns for the shoulder joint according P.N.F. Then we continued by asking the patient to repeat the diagonals actively.
- With patient In side lying with hips and knees flexed we applied passively P.N.F for both scapulas in Anterior Elevation, Posterior Depression, Anterior Depression and Posterior Elevation.
- While the patient was lying in supine position we asked him to actively flex his shoulders at 90 degrees while keeping elbows extended and try to hold his arms in space while focusing on the affected, right upper extremity and try to prevent it from deviating from that position as much as possible.
- While the patient being in sitting position we mobilized the shoulder of the patient using springing technique in dorsal direction repeating the springing for 30 times according Joint Play by Lewit.

- In side lying we mobilized patient's Right scapula in clockwise and anticlockwise directions according Joint Play by Lewit. Then we repeated the same procedure for the left scapula.
- In sitting position we passively stretched the wrist flexors by stretching passively the wrist and the fingers of the right upper extremity into extension and held it for 30 seconds. Repeated for 3 times.
- In Sitting position we asked the patient to laterally shift his body to the right side and while he was supporting his weight with the right upper extremity I was moving a soft ball around his left side of the body, the task was for him to try to catch the ball with his left ball while he was supporting his weight with his affected side so it was a dual task.
- In sitting position we asked the patient to flex both of his shoulder to 90 degrees and I was constantly moving an over ball near his right upper extremity in various positions, the task for the patient was to catch the ball with his affected side, prevent his affect side to "fall" when the ball was in high positions and also at the same time to retain his balance.
- In sitting position the patient was holding an over ball and he was instructed to slowly roll the ball along the medial sides of his lower extremity until it reaches the ground and the roll it with the same principle back up. Repeated for 10 times.
- In supine lying position we instruct the patient how to provide the bridging exercise with his knees flexed. We divided the exercise in two parts in order for the patient to better understand the components of the exercise. We first started by asking the patient to make a "small" bridge by just providing a posterior tilt of the pelvis and then to progress it into a "big" bridge by lifting upwards his pelvis while I was fixing his affected, unstable, right lower extremity and also assisting with the pelvis elevation. The patient stayed in that elevated position for approximately 5 seconds and then he returned to the starting position. Repeated for 10 times.
- In lying position we place an over ball between patients legs and asked him to press both legs towards each other in order to provoke adductions and in extension facilitate the adductors.
- In Lying position we placed a semi-inflated over ball under patient's right heel of his extended lower extremity and we asked him to use the ball as lever in order to roll it in cranial direction while flexing his knee and hip Joints and then rolling it back down to caudal direction while extending both joints. 3 sets of ten repetitions.

- In lying position and while placing his knee in extension and his hip in flexion we stretched patients triceps surae passively by dorsiflexing the foot and keeping it in this position for 30 seconds. Repeated 3 times. Provided in both LE.
- In lying position while making sure that we kept patient's right knee extended we stretched patients hamstrings passively and holding to the flexed hip-extended knee position for about 30 seconds. Repeated 3 times. Provided in Both LE.

Subjective Result

The patient was in a really good mood and smiling even though it was a long and tiring session for him. He admitted that has started getting better and he even that the sessions are getting longer it's easier for him to complete the exercises that require active participation from him.

Objective Result

I was impressed by the patient's improvement as far as his physical abilities, functionality, range of motion and also his positive attitude as well. He seemed really motivated especially in a comparison with our first session. Patient's right upper extremity is really functional and has been greatly improved as far as coordination goes but also as far as the limitations that have been created by the flexed stereotypy of the wrist and fingers. Right Lower extremity has improved really as well but it was of course more affected than the upper and needs some more time to get to the point of improved functionality. It was the first time that the patient took many steps, he actually walked from his bed to the door of the room and back which is a descent distance, even though he was using the high walker. Even though the patient was far way from having a correct walking pattern it was really impressive that only in the fourth session he was able to transfer himself with an assistive device if we consider that in the first session the patient could not even wake up from his bed without assistance. The patient had really small and unconfident steps but he was able to move forward at a good pace. Last but not least I would like to highlight that after the end of the therapy session my patient stayed at his bed and I happened to have a session with another patient at his room, at some point the patient went to sitting position without any assistance (except the horizontal bar hanging above the bed) and ate some fruits using both of his upper extremities. I observed a great improvement since he was able to coordinate his affected

upper extremity better and apply quality control with faster movements than before. Also the fact that he went from supine to sitting without assistance was a huge step up for the patient. I was really satisfied after this session since the improvement is starting to be more and more apparent and today I saw some actual improvement of ADL and some independency, which are without a doubt our main goals during this rehabilitation plan!

Therapy Session 5, Date: 27/01/2016

Status Presents

- Today is my fifth physiotherapeutic session with my patient.
- Today the patient is closing one week in the Kladno Hospital
- Today it was the first time than when I walked in, in the patient's room he was in sitting and not laying position and he was having some breakfast. I asked him if he got from supine to sitting by himself and replied that he did.
- **Blood pressure:** 120/70mmHg
- **Heart pulse:** 74/minute
- **Body Temperature:** 36 C^o

Plan Of Today's Therapy And Therapy Proposal

- Verticalize the patient, try to instruct him to increase the weight bearing of the affected, right lower extremity. Me and my supervisor agreed to try to upgrade patient's walker into a lower, folding walker without wheels which require the patient to be more active in order to further facilitate more the gait.
- Balance exercises in sitting position.
- Three-Point, small foot sensomotoric technique in seating position in order to facilitate proprioreception by Janda.
- Mobilize the pelvis and facilitate postural patterns by applying bridging exercise and according Fredericson and Moore and a modification of it.
- Exercise pelvic and lower trunk rotation in laying position in order to facilitate those movements which are highly important for the gait.
- Mobilize the joints of the lower extremity that appeared with restricted joint play.
- Facilitate the muscles of lower extremity by using strengthening and conditional exercises that focus on large muscle groups (in this case hip flexors, quadriceps, hip

adductors and hamstrings)

- Electro-gymnastics for facilitation of quadriceps femoris
- Increase the range of motion of the lower extremity by stretching the triceps surrae and the hamstring muscles (indicated by my supervisor)

Procedure

- We Started with Verticalization of the patient. I instructed the patient how to perform the 3 point gait and how to use the new walker. Also I asked him to try to actively perform dorsiflexion during the gait.
- In supine lying position we instruct the patient how to provide the bridging exercise with his knees flexed. We divided the exercise in two parts in order for the patient to better understand the components of the exercise. We first started by asking the patient to make a "small" bridge by just providing a posterior tilt of the pelvis and then to progress it into a "big" bridge by lifting upwards his pelvis while I was fixing his affected, unstable, right lower extremity and also assisting with the pelvis elevation. The patient stayed in that elevated position for approximately 5 seconds and then he returned to the starting position. Repeated for 10 times. This time we tried a modification with the left leg being adducted with knee flexed and crossed over the right lower extremity In order for the right lower extremity to provide the whole weight bearing. The patient repeated for 5 times while I stabilized his lower LE.
- In lying position with the knees flexed we asked the patient to make sure that his scapulas and shoulders retain contact with the floor the whole time the exercise takes place and we asked him to rotate his pelvis and lower trunk to left and right and make sure that the lateral part of the thigh makes contact with the bed in every rotation for him to rotate to the other side. 10 repetitions, 3 sets.
- In Sitting position we asked the patient to laterally shift his body to the right side and while he was supporting his weight with the right upper extremity I was moving a soft ball around his left side of the body, the task was for him to try to catch the ball with his left ball while he was supporting his weight with his affected side so it was a dual task.
- In sitting position we asked the patient to flex both of his shoulder to 90 degrees and I was constantly moving an over ball near his right upper extremity in various

positions, the task for the patient was to catch the ball with his affected side, prevent his affect side to "fall" when the ball was in high positions and also at the same time to retain his balance.

- In sitting position the patient was holding an over ball and he was instructed to slowly roll the ball along the medial sides of his lower extremity until it reaches the ground and the roll it with the same principle back up. Repeated for 10 times.
- In order to improve and stimulate propreoreception, we used sensomotoric training. We used a modification in sitting position based on the 3 points-small foot sensomotoric technique By Janda. In sitting position we instructed the patient to slightly external rotate his hips and perform the small foot by approximating the medial calcaneous and great toe in order to raise the longitudinal arch. We provided the approximation passively since it was a little complex for the patient to understand it and perform it actively
- We continued in lying position. We placed a vestibular ball under the patient's feet and we asked him to flex his hips and knees in order to pull the vestibular ball towards him and by extending the same joints to roll the ball away from his body, we asked the patient to consciously try to use more his affected, right lower extremity. 12 repetitions, 3 legs.
- In sitting position, we placed the patient to sit to a chair and to get without any assistance by moving his foots towards the chair, bend his whole body forward and hold the hand rest of the chair to apply pressure and get up. Repeated 3 times.
- In Lying position, the patient had flexed his right knee and while I was sitting on his right foot I mobilized his head of fibula in ventral and dorsal direction by springing technique it 30 times in each direction, according Joint Play by Lewit
- In lying position I mobilized patient's Lisfranc's Joint of the foot in dorsal and ventral direction, using springing technique for 30 times in each direction according Joint Play by Lewit.
- In lying position I mobilized patient's Chopart's Joint of the foot in dorsal and ventral direction, using springing technique for 30 times in each direction according Joint Play by Lewit.
- We used electro-gymnastics for facilitation of quadriceps femoris, Intensity: 36mA, Frequency: 50Hz, Impulse: 300ms, Stimulation of contraction: 5s, Pause: 25s. We asked the patient to actively contract his quadriceps isometrically during the 5 seconds of the contraction.

- In lying position and while placing his knee in extension and his hip in flexion we stretched patients triceps surrae passively by dorsiflexing the foot and keeping it in this position for 30 seconds. Repeated 3 times. Provided in both LE.
- In lying position while making sure that we kept patient's right knee extended we stretched patients hamstrings passively and holding to the flexed hip-extended knee position for about 30 seconds. Repeated 3 times. Provided in Both LE.

Subjective Result

The patient kept saying that day by day he feels much better and even though I can say that he is getting tired during the exercise circle he stopped saying that by himself. Also I had a conversation with patient's ergotherapist and she told me that she was impressed by his progress according his general state and also his fine motor control.

Objective Result

The patient is doing great and I think that the reason for that is his great attitude towards the rehabilitation process and also his will to get better. Today it was the first day that the patient walked in the corridor of the hospital and I was actually amazed by how quickly he adapted to his new walker which required more effort by him. The patient still has issues with his gait since the swing and the stance phase are absent and the patient is still first making contact with the floor using the whole foot sole but the fact that he is starting to move and transfer himself in satisfying distances it great. Since even from the last session I saw great functionality of the affected upper extremity. A positive result is that all the restricted joints according joint play by Janda of the lower extremity are now released. I decided to dedicate my last sessions with the patient mostly on facilitating lower extremity, improve balance and to gait training.

Therapy Session 6, Date: 28/01/2016

Status Presents

- Today is my sixth physiotherapeutic session with the patient.
- Once I arrived at his room he was visited by his wife. The patient smiled and introduced me to his wife and she told me that her husband is going so much better.
- While I was waiting for the patient to finish the meeting he had with his wife the physiotherapist who works with my patient in the afternoons and also during the

weekend told me that she is really impressed with my patient's progress and also that it is very rare for a patient with such acute initial status to make such fast and upturning progress.

- **Blood pressure:** 120/80mmHg
- **Heart pulse:** 76/minute
- **Body Temperature:** 36, 2 C^o

Plan Of Today's Therapy And Therapy Proposal

- Verticalize the patient.
- Balance exercises in sitting position.
- Three-Point, small foot sensomotoric technique in seating position in order to facilitate proprioreception.
- Mobilize the pelvis and facilitate postural patterns by applying bridging exercise and according Fredericson and Moore and a modification of it.
- Exercise pelvic and lower trunk rotation in lying position in order to facilitate those movements which are highly important for the gait.
- Facilitate the muscles of lower extremity by using strengthening and conditional exercises that focus on large muscle groups (in this case hip flexors, quadriceps, hip adductors and hamstrings)
- Facilitate dorsiflexion of the right foot while the patient is training gait, instruct him to understand when the Walkaide is stimulating the contraction and to try to actively contract and facilitate dorsiflexion by him feels at the same time.
- Active training of muscles of the lower extremity using Motomed Morbike in lying position

Procedure

- We Started with Verticalization of the patient. , try to instruct him to increase the weight bearing of the affected, right lower extremity. My supervisor suggested to use a device called Walkaide which is basically a mobile device that uses functional electrical stimulation (FES) in order to facilitate the peroneal nerve to cause a contraction that will lead to dorsal flexion during gait and in extension a walking pattern that will include a swing phase and thus decrease or eliminate the dropped foot phenomenon.
- In Sitting position we asked the patient to laterally shift his body to the right side and

while he was supporting his weight with the right upper extremity I was moving a soft ball around his left side of the body, the task was for him to try to catch the ball with his left ball while he was supporting his weight with his affected side so it was a dual task.

- In sitting position we asked the patient to flex both of his shoulder to 90 degrees and I was constantly moving an over ball near his right upper extremity in various positions, the task for the patient was to catch the ball with his affected side, prevent his affect side to "fall" when the ball was in high positions and also at the same time to retain his balance.
- In sitting position the patient was holding an over ball and he was instructed to slowly roll the ball along the medial sides of his lower extremity until it reaches the ground and the roll it with the same principle back up. Repeated for 10 times.
- In sitting position we placed a vestibular ball in front of the patient and asked him to roll it as far away as possible away from him and then rolling it back and trying to retain his balance at the same time. Repeated for 15 times.
- In order to improve and stimulate propreOception, we used sensomotoric training. We used a modification in sitting position based on the 3 points-small foot sensomotoric technique By Janda. In sitting position we instructed the patient to slightly external rotate his hips and perform the small foot by approximating the medial calcaneous and great toe in order to raise the longitudinal arch. We provided the approximation passively since it was a little complex for the patient to understand it and performe it actively
- In supine lying position we instruct the patient how to provide the bridging exercise with his knees flexed. We divided the exercise in two parts in order for the patient to better understand the components of the exercise. We first started by asking the patient to make a "small" bridge by just providing a posterior tilt of the pelvis and then to progress it into a "big" bridge by lifting upwards his pelvis while I was fixing his affected, unstable, right lower extremity and also assisting with the pelvis elevation. The patient stayed in that elevated position for approximately 5 seconds and then he returned to the starting position. Repeated for 10 times. This time we tried a modification with the left leg being adducted with knee flexed and crossed over the right lower extremity In order for the right lower extremity to provide the whole weight bearing. The patient repeated for 5 times while I stabilized his lower LE.

- In lying position with the knees flexed we asked the patient to make sure that his scapulas and shoulders retain contact with the floor the whole time the exercise takes place and we asked him to rotate his pelvis and lower trunk to left and right and make sure that the lateral part of the thigh makes contact with the bed in every rotation for him to rotate to the other side. 10 repetitions, 3 sets. After that we also use a modification of this exercise with the left LE being extended and the right knee flexed. Repeated for 7 times.
- We continued in lying position. We placed a vestibular ball under the patient's feet and we asked him to flex his hips and knees in order to pull the vestibular ball towards him and by extending the same joints and to roll the ball away from his body, we asked the patient to consciously try to use more his affected, right lower extremity. 12 repetitions, 3 sets.
- In lying position we place an over ball between patients legs and asked him to press both legs towards each other in order to provoke adductions and in extension facilitate the adductors.
- In sitting position, we placed the patient to sit to a chair and to get up without any assistance by moving his foots towards the chair, bend his whole body forward and hold the hand rest of the chair to apply pressure and get up. Repeated 3 times.
- In lying position, the patient had flexed his right knee and while I was sitting on his right foot I mobilized his head of fibula in ventral and dorsal direction by springing technique it 30 times in each direction, according Joint Play by Lewit.
- In lying position and while placing his knee in extension and his hip in flexion we stretched patients triceps surrae passively by dorsiflexing the foot and keeping it in this position for 30 seconds. Repeated 3 times. Provided in both LE.

Subjective Result

The patient mentioned that he is doing better and that he found the walkaide really helpful for his walking. He also mentioned that he felt more confident, stable and safe during the gait.

Objective Result

Patient's feedback was also visible by me as well. I have not seen him more confident with his gait until now and also I was impressed with the device walkaide we used which I saw for the first time and I was not familiar with but I could actually saw some dorsal flexion during his gate. The patient was in a great mood once more and today he provided the exercises in the best form from the day we started the rehabilitation.

Therapy Session 7, Date: 29/01/2016

Status Presents

- Today is my seventh final and physiotherapeutic session with the patient.
- The patient is in great mood.
- After our last session which takes place today today the patient will stay at the hospital for one more week and then he will continue his rehabilitation with the great physiotherapeutic team of Kladno hospital.
- After that the patient will continue the rehabilitation visiting a physiotherapeutic ambulance as an outpatient near his home.
- **Blood pressure:** 120/70mmHg
- **Heart pulse:** 71/minute
- **Body Temperature:** 36, 2 C^{o}

Plan Of Today's Therapy And Therapy Proposal

*Today we had very limited time because I had to complete the final kinesiologic examination with the patient. As far as therapy goes we mainly focused on gait training.

- Gait training.
- Mobilize the pelvis and facilitate postural patterns by applying bridging exercise and according Fredericson and Moore and a modification of it.
- Exercise pelvic and lower trunk rotation in lying position in order to facilitate those movements which are highly important for the gait.
- Increase the range of motion of the lower extremity by stretching the triceps surrae and the hamstring muscles (indicated by my supervisor)

Procedure

- We started with gait training incorporating learning to take advantage of the walkaid, education of the patient according phases of a correct gait pattern, stimulating stance and swing phase and also active training of dorsiflexion in standing position.
- In supine lying position we instruct the patient how to provide the bridging exercise with his knees flexed. We divided the exercise in two parts in order for the patient to better understand the components of the exercise. We first started by asking the patient to make a "small" bridge by just providing a posterior tilt of the pelvis and then to progress it into a "big" bridge by lifting upwards his pelvis while I was fixing his affected, unstable, right lower extremity and also assisting with the pelvis elevation. The patient stayed in that elevated position for approximately 5 seconds and then he returned to the starting position. Repeated for 10 times. This time we tried a modification with the left leg being adducted with knee flexed and crossed over the right lower extremity In order for the right lower extremity to provide the whole weight bearing. The patient repeated for 5 times while I stabilized his lower LE.
- In lying position with the knees flexed we asked the patient to make sure that his scapulas and shoulders retain contact with the floor the whole time the exercise takes place and we asked him to rotate his pelvis and lower trunk to left and right and make sure that the lateral part of the thigh makes contact with the bed in every rotation for him to rotate to the other side. 10 repetitions, 3 sets. After that we also use a modification of this exercise with the left LE being extended and the right knee flexed. Repeated for 7 times.
- In lying position and while placing his knee in extension and his hip in flexion we stretched patients triceps surae passively by dorsiflexing the foot and keeping it in this position for 30 seconds. Repeated 3 times. Provided in both LE.
- In lying position while making sure that we kept patient's right knee extended we stretched patients hamstrings passively and holding to the flexed hip-extended knee position for about 30 seconds. Repeated 3 times. Provided in Both LE.

Subjective Result

The patient was really grateful and thanked me and my supervisor for the co-operation and that he feels much better only after 7 sessions.

Objective Result

The patient really amazed and I was really happy after the last brief therapy we had since I detected a big improvement in the patient's perception and his ability to understand tasks and instructions from a therapist which was an issue for him in the beginning. Since today the final kinesiological examination took place as well the results will be listed in the respective section below.

3.6 Final Kinesiologic Examination

- Observation
- Examination of higher functions
- Postural examination
- Gait examination
- Breathing examination
- Anthropometric measurements
- Soft tissue examination by Lewit
- Examination for spasticity
- Muscle tone examination (palpation)
- Muscle Length Examination By kendall
- ROM examination (SFTR Method) by Russe and Gerhard
- Joint play examination by Lewit
- Neurological examination
- Examination of ADL activities and Functional assessments

3.6.1 Observation

The patient seems to be like a complete different person than the one I met 9 days ago, physically but mentally as well. He is much more active and he spends most of his time in sitting position during his free time now than lying down to his bed since he prefers it as he told me. I observed the patient reading the paper, eating an apple, putting on his socks e.t.c. and I was very surprised by how improved his ability to perform daily tasks like these was as far as quality of motor control, speed, balance and accuracy goes. Also the patient seems much more aware of his affected, right side and it seems that he is consciously trying to use it as much as possible which is highly important if we bring to our minds that the doctors had declared early signs of neglect syndrome in his first day

at the hospital. Last but not list I would like to highlight that even if the patient is far from being fully independent yet, observing performing any task it is obvious that his dependency is has improved enormously.

3.6.2 Examination of Higher Functions

- We asked the patient What is the year? Season? Date? Day of the week? Month? SCORE: 5/5
- We asked the patient "Where are we now Country? Town/city? Hospital? Floor? SCORE: 5/5
- We named three objects (a pencil, a watch and a phone) and we asked the patient to repeat all of them. SCORE:3/3
- We asked the patient to count backward from 100 by sevens. SCORE: 4/5, *the patient did some minor mistakes in the numbers.
- We asked the patient to repeat naming the tree objects we named before. SCORE: 3/3
- We showed the patient two objects (a paper and a small soft ball) and ask the patient to name them. SCORE: 2/2
- Asked the patient to repeat the phrase: Prague's first steamboat in Czech (prvni prazska paroplavba). SCORE: 0/1, The patient had trouble repeating the phrase correctly and misspelled the words.
- We asked the patient to take a paper fold it in half and put it on the floor. 2/3
- We showed the patient a paper which said close your eyes and asked the patient to do what it says. SCORE: 1/1
- We asked the patient to form a sentence using a noon and verb. SCORE: 1/1
- We showed the patient a picture of two hexagons that are intersecting with each other and we asked the patient to draw what he saw in a blank paper. SCORE: 0/1

TOTAL SCORE: 26/30

3.6.3 Postural Examination

*I should be highlighting that the initial and final postural examinations took place under completely different circumstances. During the initial postural examination the patient had assistance by my supervisor and a nurse and was using a high walker where he was supported by his forearms and elbows. During the final postural examination the patient stood with a normal walker approximately at the height of his hips where he used the handles with his palms to support himself and moreover he did not require any support and/or assistance by another person. Once again I should be mentioning that since the patient is standing supported by his walker the posture is heavily influenced by that and the posture appears plasmatic. Although we could not examine the posture without any assistive equipment yet.

Posterior View:

- Narrow base of support.
- Patient's lateral part of Right Foot is in contact with the right "leg" of the walker while left foot is approximately in a position 25 cm away from the left "leg of the "walker".
- Weight bearing is not equally Divided between the two Lower Extremities
- More weight bearing in the left lower extremity.
- Patient's whole right side of the body is really close to the right part of the walker while the left side of the body is away from the left side of the walker-No symmetrical position of the patient in relationship with the walker.
- Whole body is tilted to the left side.
- Left shoulder slight higher than the right.
- Head slightly sifted to the right.

Lateral View (left side)

- Whole Body is tilted forward.
- Slightly flexed left knee.
- Semi-flexed trunk.
- Lumbar spine appears flat.
- Thoracic spine in kyphosis.
- Right shoulder appears protruded.

Lateral View (right side)

- Whole body tilted forward
- Right ankle plantar flexed.
- Right knee slightly flexed.
- Right hip flexed.
- Anterior tilt of pelvis.
- Lumbar spine appears flat*..
- Right shoulder appears protruded.
- Thoracic spine in kyphosis*.
- Cervical spine flexed.

3.6.4 Gait Examination

For the final gait examination the patient used a normal folded walker approximately at the height of his hip, he was using the handles of the walker by grabbing them by his hands in order to support himself. Also my supervisor had place a walkaide in the lateral part of his calf which works with functional electric stimulation which assisted in dorsal flexion of the foot by stimulating muscle contractions. Patient's new walker does not have wheels like the first high walker we used for the first few days. The patient was instructed how to perform 3 point alternate gait with the walker where he was first moving the walker, then the right, affected lower extremity and the left lower extremity. This time the patient actually crossed a significant distance and he actually moved and had steps in contrast with the initial gait examination. The patient was moving the walker slightly forward from him in order to retain a good support and stability. As far as the affected, right lower extremity, the steps were small in length, but there was actually some limited dorsal flexion presence (Walkaide was activated) and so we can say that there was a stance phase since there is some contact of the heel with the floor 1 or 2 milliseconds before the rest of the foot steps down. The swing phase is limited, the patient internally rotates the ankle and inverts and plantar flexes the foot and the last contact with the floor is done by the lateral part of the foot and the small toe. The steps of the left lower extremity were small but wider in length than the ones of the right one, I would say the stance phase of the Left LE was longer than the really limited one of the right. The patient did noise steps and had a narrow base of support. The trunk and the pelvis were both pretty stiff during the gait although there was some slight pelvis

rotation. The patient felt really comfortable and walked for about 20 meters stopped from his room to the end of the corridor then rest a little bit and walked back. I would say that the quality of the gait was decreased through the last few meters since the patient was quite fatigued which is absolutely justified.

3.6.5 Breathing Examination

During the breathing examination once again the patient was lying to his bed in supine position with his knees flexed. The patient seemed to have incorporated more abdominal breathing to his breathing pattern although I did not observe any activation of the lower abdominals once again. The lower thorax was seemed to have better mobility, the movement and mobility of the ribs remained physiological.

3.6.6 Anthropometric Measurements

Lower Extremities	**Left LE**	**Right LE**
Functional length ASIS	90 cm	90,5 cm
Anatomical length	83 cm	83,5 cm

Table 21- Final Anthropometric Measurements For Length Of Lower Extremities.

Lower Extremities	**Left LE**	**Right LE**
Thigh (15 cm above knee)	42 cm	41 cm
Thigh (10 cm above knee)	38 cm	38 cm
Knee	34 cm	34 cm
Calf	31 cm	30 cm
Ankle	29 cm	29 cm
Foot	25 cm	25 cm

Table 22- Final Anthropometric Measurements For Circumference Of Lower Extremities.

3.6.7 Soft tissue examination by Lewit

The restricted facias of the lower extremity which were the anterior part of the right and left thigh in cranial and caudal examination and the fascias around both of the patient's calfs in medial and lateral direction are not restricted any more since they got released. The skin and the subskin of the lower extremities remained unrestricted.

3.6.8 Examination for spasticity

*We provided the examination in the right, affected upper extremity. The results were listed in the following table:

Joint Examined	Score
Flexion of the wrist	0
Extension of the wrist	1
Extension of the fingers	1
Extension of the elbow	0
Extension of the elbow	0

Table 23- Final Examination For Spasticity According To Modified Ashworth Scale.

3.6.9 Muscle tone examination (palpation)

I provided palpation to the following muscles in order to distinguish the level of their muscle tone. The following tables list the findings of the examination:

Upper extremity		
Muscle	**Left**	**Right**
M. Biceps Brachii	Physiological	Physiological
M. Triceps	Physiological	Hypotonic
Pectoralis Major	Physiological	Physiological
Supraspinatus	Hypotonic	Hypotonic
Infraspinatus	Hypotonic	Hypotonic

Deltoid (Anterior)	Physiological	Physiological
Deltoid (Middle)	Physiological	Physiological
Deltoid (Posterior)	Physiological	Physiological
M. Brachioradialis	Physiological	Hypertonic
M. Pronator teres	Physiological	Hypertonic
M. Flexor carpi radialis	Physiological	Hypertonic
M. Flexor carpi ulnaris	Physiological	Hypertonic
M. Extensor carpi radialis	Physiological	Hypotonic
M. Extensor carpi ulnaris	Physiological	Hypotonic
Lower extremity		
Muscle	**Left**	**Right**
M. Tensor fascia latae	Hypotonic	Hypotonic
M. Rectus femoris	Physiological	Physiological
M. Vastus lateralis	Physiological	Physiological
M. Vastus medialis	Physiologica	Physiological
M. Sartorius	Hypotonic	Hypotonic
M. Adductor magnus	Hypotonic	Hypotonic
M. Illipsoas	Hypotonic	Hypotonic
Gastrocnemious	Physiological	Physiological
Soleus	Physiological	Physiologica;
Tibialis anterior	Physiological	Hypotonic

Table 24- Final Examination of Muscle Tone By Palpation.

3.6.10 Muscle Length Test Examination by Janda

Muscle	Left	Right
Gastrocnemius	0	1
Soleus	0	1
Hamstrings	0	0

Table 25- Final Examination of Muscle Length according to Janda

3.6.11 ROM examination (SFTR Method) by Russo and Gerhard

HIP JOINT				
Plane	**Left side**		**Right side**	
	Active Movement	**Passive Movement**	**Active Movement**	**Passive Movement**
S	*0º – 0º – 110º	*0º – 0º – 130º	*0º – 0º – 110º	*0º – 0º – 130º
F	25º – 0º – 25º	35º – 0º – 25º	25º – 0º – 20º	35º – 0º – 20º
Rs	*0º – 0º – *0º	45º – 0º – 20º	*0º – 0º – *0º	30º – 0º – 20º

Table 26- Range of motion of hip joint

KNEE JOINT				
Plane	**Left side**		**Right side**	
	Active Movement	**Passive Movement**	**Active Movement**	**Passive Movement**
S	0º – 0º – 125º	0º – 0º – 130º	0º – 0º – 110º	0º – 0º – 120º

Table 27- Range of motion of knee joint

ANKLE JOINT				
Plane	**Left side**		**Right side**	
	Active Movement	**Passive Movement**	**Active Movement**	**Passive Movement**
S	5º – 0 – 55º	10º – 0 – 60º	0º – 0 – 40º	0º – 0 – 60º

Table 28- Range of motion of ankle joint

SHOULDER JOINT				
Plane	**Left side**		**Right side**	
	Active Movement	**Passive Movement**	**Active Movement**	**Passive Movement**
S	*0º – 0º – 170º	*0º – 0º – 175º	*0º – 0º – 125º	*0º – 0º – 155º
F	0º – 0º – 155º	0º – 0º – 160º	0º – 0º – 120º	0º – 0º – 140º
R	90º – 0º – 70º	90º – 0º – 85º	60º – 0º –75º	90º – 0º – 90º

Table 29- Range of motion of shoulder

ELBOW JOINT				
Plane	**Left side**		**Right side**	
	Active Movement	**Passive Movement**	**Active Movement**	**Passive Movement**
S	0º – 0º – 145º	0º – 0º – 145º	0º – 0º – 145º	0º – 0º – 145º

Table 30- Range of motion of elbow joint

RADIOULNAR JOINT				
Plane	**Left side**		**Right side**	
	Active Movement	**Passive Movement**	**Active Movement**	**Passive Movement**
R_s	90º – 0º – 90º	90º – 0º – 90º	90º – 0º – 90º	90º – 0º – 90º

Table 31- Range of motion of radioulnar joint

WRIST JOINT				
Plane	**Left side**		**Right side**	
	Active Movement	**Passive Movement**	**Active Movement**	**Passive Movement**
S	60º – 0º – 50º	80º – 0º – 80º	40º – 0º – 80º	80º – 0º – 90º

Table 32- Range of motion of wrist joint

3.6.12 Joint play examination by Lewit

I examined the Joint play of the following joints listed at the table below:

Upper extremity		
Joint	**Left**	**Right**
Shoulder Joint (all directions)	Not Restricted.	Not Restricted
Scapula	Not Restricted	Restricted
Acromioclavicular Joint	Not Restricted	Not Restricted
Sternoclavicular Joint	Not Restricted	Not Restricted
Elbow Joint	Not Restricted	Not Restricted
Radiocarpal Joint	Not Restricted	Not Restricted
Carpometacarpal Joint	Not Restricted	Not Restricted
Carpal Bones	Not Restricted	Not Restricted
Carpometacarpal Joint of the thumb	Not Restricted	Not Restricted
Metacarpophalangeal Joints	Not Restricted	Not Restricted
Interphalangeal Joints	Not Restricted	Not Restricted

Table 33- Initial Examination of Joint Play by Lewit in Upper Extremity.

Lower extremity		
Joint	**Left**	**Right**
Sacroiliac joint	Not Restricted	Restricted
Patella	Not Restricted	Not Restricted
Knee joint	Not Restricted	Not Restricted
Tibiofibular joint	Not Restricted	Not Restricted
Talocrural joint	Not Restricted	Not Restricted
Subtalar joint	Not Restricted	Not Restricted
Talocalcaneonavicular joint	Not Restricted	Not Restricted
Lisfranc's joint	Not Restricted	Not Restricted
Chopart's joint	Not Restricted	Not Restriction
Metatarsophalangeal Joints	Not Restricted	Not Restricted
Interphalangeal Joints	Not Restricted	Not Restricted

Table 34- Final Examination of Joint Play by Lewit in Lower Extremity.

3.6.13 Neurological examination
Examination of Cranial Nerves

Cranial nerve	Outcome
I. Olfactory	Physiological
II. Optic	Physiological
III. Oculomotor	Physiological
IV. Trochlear	Physiological
V. Trigeminal	Physiological
VI. Abducens	Physiological
VII. Facialis	Possible Pathological Sign*
VIII. Vestibulocochlear	Possible Pathological Sign**
IX. Glossopharyngeal	Physiological
X. Vagus	Physiological
XI. Accessory	Physiological
XII. Hypoglossal	Physiological

Table 35- Final Examination of Cranial Nerves.

*The patient could provide most of the facial expressions, like smiling when he was asked to. Although when he was asked to puff out his cheeks he was not able to do it. Also the patient was not able to swipe his lips together when he was asked for it. This is not a necessarily pathological sign put it should be noted. As noted already on the observation segment of the initial examination the face of the patient looks symmetrical.

**The patient had impaired hearing in the right ear. Although it is important to underline that the patient had a rapture of his tympanic membrane when he was younger (as already mentioned in the anamnesis) and he has suffered hearing loss since then. So the finding is probably caused by that and not by an impaired Vestibulocochlear nerve but since we cannot be 100 % sure it should be noted.

Examination of Superficial Sensation

I examined the superficial sensation by applying light touch in various dermatomes of patient's body in both sides of his body. The results of the examination are listed in the following table:

Dermatome	Left Side	Right Side
C5	Physiological	Physiological
C6	Physiological	Physiological
C7	Physiological	Physiological
C8	Physiological	Physiological
T1	Physiological	Physiological
T2	Physiological	Physiological
T3	Physiological	Physiological
L2	Physiological	Physiological
L3	Physiological	Physiological
L4	Physiological	Hyposensitivity appears
L5	Physiological	Hyposensitivity appears
S1	Physiological	Hyposensitivity appears
S2	Physiological	Normal

Table 36- Final Examination of Superficial Sensation.

Examination Of Deep Tendon Reflexes

I completed this examination using a standard neurological hammer. The following grading system was used to measure the results: 0 -Absent Reflex, 1-Hypoactive Reflex or present only reinforcement, 2-Readily Elicited with a normal response, 3-Brisk Reflex with or without evidence of spread to the neighboring roots, 4-Unsustained Clonus, 5-Substained clonus. The results are listed in the following table:

Segment	**Grade Left Side**	**Grade Right Side**
Biceps, C5-C6	3	3
Triceps, C7	3	3
Brachioradialis, C5-C6	3	3
Flexors, C8	3	3

Patellar, L2-L4	4	4
Achilles, L5-S2	2	2

Table 37- Final Examination of Deep Tendon Reflexes.

Examination of Deep Sensation

In order to examine the deep sensation we tested kinesthesia and discrimination (graphesthesia, stereognosia, two-point discrimination)

Kinesthesia: Like in the initial examination the patient had pathological response in the joints below the knee (Ankle, great toe) and above the elbow (Wrist, fingers) where with closed eyes he was unable to distinguish the movement and the position of the joints

Graphesthesia: While the patient kept his eyes closed with the tip of a pen I draw the number 7 in his palm and I asked him to identify it. The patient once again was unable to identify it.

Stereognosis: I place a pen in the patients hand while he eyes was closed and asked him to identify what object I gave him. He was able to do it like he did in the initial examination.

Two-Point Discrimination: With a paper clip which was modified to have two sharp edges I alternatively touched the patient with one sharp edge and with both sharp edges and I asked the patient to identify if he was touch by one or two edges. The patient could not discriminate it in his fingers, wrist and up the middle forearm in his upper extremity and in his toes, foot and ankle and up until the calf in the lower extremity.

Examination Of Cerebelar Signs

Finger to nose test : The patient was asked to alternatively touch the tip of my index finger and his nose. The patient was able to perform the test .

Test of rapid Alternative Movements: The patient was asked to clasp his palms while he was pronating and supinating his forearms. The patient was able to perform.

Test for dysrhrythmia: The patient was asked to tap his palm in his thigh in a steady rhythm or temp. The patient was able to perform the test.

Knee to heel test: The test was positive once again although the patient had much better performance than the initial examination.

Examination of Primitive Reflexes

The results of the examination are listed in the following table:

Reflex	Outcome
Palmomental Reflex	Negative
Palmar Grasp Reflex	Negative
Glabellar tap Reflex	Positive

Table 38- Final Examination of Primitive Reflexes.

Examination of Pathological Reflexes- Pyramidal Signs

Examination of Spastic (irritative) Signs

Spastic Sign	Outcome
Upper Extremity	
Juster's Sign	Negative
Trommner Sign	Negative
Hoffman's Sign	Negative
Lower Extremity	
Babinski´s sign	Negative
Vítek´s summed sign	Negative
Roche´s sign	Negative
Oppenheim's Sing	Negative
Siccard's sign	Negative
Mendel-Bechterev's Sing	Negative
ZukovskiJ-Kornilov's Sign	Negative
Rossolimo's Sign	Negative

Table 39- Final Examination of Spastic (irritative) Signs.

Examination of Paretic Signs

*This time in contrast with the initial examination the patient was aware of his paretic signs although once again they were once again positive the paretic, right side was more stable and much closer to the non-affected side in response than the initial testing.

Paretic Sign	Outcome
Upper Extremity	
Mingazzini	Positive
Dufour	Positive
Barré	Positive
Hanzal	Positive
Rusedskij	Positive
Lower Extremity	
Mingazzini	Positive
Barré I	Positive
Barré II	Positive
Barré III	Positive

Table 40- Final Examination of Paretic Signs.

3.6.14 Examination of ADL and Functional assessments

Examination of ADL (Activities of Daily Living):

I examined and reviewed the ability of the patient to perform the following activities of daily living:

- **Ability to eat/drink:** The patient is able to feed himself in a more quality way than he did in the initial examination, he is forcing himself to use his affected, right upper extremity as much as possible. His speed an quality of fine movement, for example using a fork was much improved.
- **Ability to dress:** The patient is able to dress himself with the assistance of another person, he is able to put on his socks and shoes by himself.
- **Ability to undress:** The patient is able to dress himself with the assistance of another person. Although he was able to be much more active in comparison with the initial testing of undressing.
- **Ability to transfer himself:** The patient is able to transfer himself in small distances using a normal walker and the walkaide attached to his right lower extremity. He is able to walk to the corridor and go from his room to the gym and also to the ergotherapy room which is about 15-20 meters away from his room.
- **Ability to use the toilet:** The patient is still not able to use the toilet by himself. A catheter has been inserted in his urethra and he is wearing a diaper.

- **Ability to wash/bath:** The patient still is not able to wash himself. He needs assistance by the nurse. Although he is now able to walk until he reaches the bathroom using his walker.
- **Ability to write**: The patient was able to write a word using his right, affected upper extremity the graphic character became more distinguishable and he did not face any difficulty achieving that.
- **Ability to use his cell phone:** The patient is regularly calling his wife and son or receives calls from them so I tried to examine his ability to do so. The patient is able to text a number, the quality of his fine motor movements has much increased.
- **Moving from the bed (from lying to sitting and vise/versa, rolling from one side of the bed to the other):**The patient uses a horizontal bar hanging above his bed to lift his self in order to go to a sitting position without assistance, he is able to roll from one side of the bed to another.

Examination of functional assessments

I used some functional tests expect the ADL examination in order to further review patient's independence and abilities like his balance. The tests I used are the following accompanied by their outcomes:

- **Functional Reach Test:** This test usually takes place in standing position but the patient performed it in sitting due to his inability to stand alone. The patient was asked to reach with stretched arm to grab a bottle of water from me while I was away from him. The patient was able to grab the bottle with his left once again but the important finding was that he was able to reach it and grab it with his right upper extremity as well.
- **From Sitting to Standing Test:** The patient was able to perform the test by himself using his walker for support which (the walker) is able to reach by himself from his bed.
- **From Standing to Sitting:** The patient was only able to perform the test although with not great confidence and slowly.
- **Pick up an object from the floor:** The patient was able to perform the test from sitting position but he performed the task really easily.
- **Turning to look behind over both shoulders:** The patient was able to perform test.
- **Get up and Go test:** The patient could perform the test using his walker while the walkaide attached to his right calf was activated.

3.7 Evaluation OF The Effect of The Therapy

During the seven therapy sessions I had with the patient I have to say that from the first day until the seventh and final day, the patient went through a wide and impressive arch of improvement which was almost life changing for him. If we individually compare the initial and final examinations we will distinguish many similarities between the initial and the final findings but I can assure the readers of this bachelor thesis that the patient was a different man after the end of the therapies. That is why I think that the most representative and fundamental results of the final examination are those of the ADL and Functional assessment examinations. Of course there were many more improved factors if we compare the initial and final findings. Let us review and of the results of the final kinesiological examination by comparing them to the respective findings of the initial kinesiological examination we can better evaluate the effect of the therapy applied. After the final examination just from observing the patient the improvement was obvious with a much more functional active patient appearing after the end of the therapies. As far as cognition goes there was not any significant change since right of the start patient's mental state was in pretty good condition, although the patient scored 26/30 points in the final MMSE 1 point higher that the initial 25/30 which was already a good score. As far as the posture goes I think that the highlight is that the patient needed a big, really heavy, highly assistive high walker and assistance from two persons two stand in the initial examination and just a standard, folding walker and no assistance in order to stand during the respective final examination. The comparison between the initial and final gait examination is definitely one of the highlights of this case study and in extension one of the main reason that the final findings of the ADL-Functional examinations had been much improved. The patient could only take three or four steps during the initial examination, assisted by 2 persons, using a high walker with wheels and despite those facts he did not move any forward which is the main point of walking. As of the final examination the patient was able to use a standard walker and by using the three point alternate gait was able to walk for significant distances inside the hospital and in the corridor, being much more stable and safe than the first day and with an increased endurance as well. The patient had an improved breathing pattern after the final examination and also the tonus of the affected side was slightly increased. In this point I have to declare than even though a lot of muscles that were found hypotonic after the initial examination and appeared again hypotonic again after the final one had

an improved tone, just not physiological yet with the same principle applying to the hypertonic muscles of the final kinesiological examination. The range of motion was much improved, increased in almost all joints with the hip joint of the right LE having the most impressive improvement. The lengthening of the shortened muscles of the lower extremity, the release of every joint that appeared restricted during the initial examination of Joint Play according Janda along with the release of the restricted fascias and the general improvement in the physical condition of the patient all played an important role in the improvement of R.O.M had during the 7 therapies we had. It is really logical and physiological in a diagnosis like this that all the positive neurological signs of the initial neurologic examination remained the same after the final just 8 days after the initial one. Just but not least and in my opinion the reason that the therapy effect of this case was highly successful is that the daily activities and the functional assessments that were examined were highly improved or even restored after the 7 therapy sessions we had which made the patient being from completely dependent to external assistance to having a satisfying level of independence as far as simply daily activities inside the hospital goes.

3.7.1 Prognosis

If we carefully review and evaluate the improvement of the patient described in the evaluation of the therapy above and consider the importance of the achievements of the patient in such limited space of time we can safely suggest that the patient has a great prognosis in the depth of time if he continues to show the amazing positive attitude and the determination he showed me during those 8 days we spent working together. I am sure he will.

4. Conclusion

I really did not know what to expect when I started my practice at Oblastni Kladno Nemosnice. Soon I realized that I was working with a very nice supervisor and team of people both as persons and as physiotherapists. I really wanted to work with a patient suffering from a neurological disorder such as stroke since I am really interested in the topic and also because I find really challenging and fulfilling to help patients reach goals that a most of us are taking for granted, goals like walking again, restore the ability to do daily activities or achieve independence. I immediately liked my patient who seemed a really nice and kind person. During my practice I learned a lot of

important things like how is to work with the same patient day by day, how you have to build a trustworthy relationship with the patient in order to succeed, how important the motivation is for both the physiotherapist and the patient and most importantly that rehabilitation is one hundred present a two-way process as far as the persons involved. Both the physiotherapist and the patient must share the same goals and share the same working attitude in order for the process to be successful. That is why my patient's tremendous improvement was so important and satisfying for me and changed my perspective on physiotherapy which became much more important in my mind than it used to be.

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6.Supplements

6.1 Ethical Board

UNIVERZITA KARLOVA V PRAZE
FAKULTA TĚLESNÉ VÝCHOVY A SPORTU
José Martího 31, 162 52 Praha 6-Veleslavín

Application for Approval by UK FTVS Ethics Committee

of a research project, thesis, dissertation or seminar work involving human subjects

The title of a project: Ischemic Cerebrovascular Accident (Stroke)
Project form: bachelor
Period of realization of the project: January 2016
Applicant: Minas Kouroglou
Main researcher: Minas Kouroglou
Co-researcher(s):
Supervisor (in case of student's work): Mgr. Helena Vomáčková
Financial support:

Project description: Physiotherapeutic rehabilitation in 75 years old patient patient in sub-acute phase after ischemic CVA (Stroke). The main goals of the rehabilitation process was to increase the Range of motion of the patient, facilitate the muscles of the affected side of the body, prevent secondary complications, restore functionality of the patient, restore the ability to walk and to improve patient's ability to do activities of daily living and increase his independence to a satisfying level. All the methods and techniques i used where taught to me at the faculty of physical education and sport, UKFTVS of Charles University of Prague during my Bachelor Degree Program.

Ensuring safety within the research: I had my practice in Oblastni Nemocnice Kladno. Non- invasive methods were used. All the examination and therapy procedures where provided under the constant supervision of my supervisor, Bc.Tomas Modlinger. All the precautions and risk preventions were followed according to the specific hospital rules,

Ethical aspects of the research: All the members and, or participants in the research project are adults and non vulnerable. All the personal data are anonymous and will remain anonymous.

Informed Consent: attached

It is a duty of **all participants of the research team** to protect life, health, dignity, integrity, the right to self-determination, privacy and protection of the personal data of all research subjects, and to undertake all possible precautions. Responsibility for the protection of all research subjects lies on the researcher(s) and not on the research subjects themselves, even if they gave their consent to participation in the research. All participants of the research team must take into consideration ethical, legal and regulative norms and standards of research involving human subjects applicable not only in the Czech Republic but also internationally.

I confirm that this project description corresponds to the plan of the project and in case of any change, especially of the methods used in the project, I will inform the UK FTVS Ethics Committee, which may require a re-submission of the application form.

In Prague, 1/4/2016 Applicant's signature:

Approval of UK FTVS Ethics Committee

The Committee: Chair: doc. PhDr. Irena Parry Martínková, Ph.D.
Members: prof. PhDr. Pavel Slepička, DrSc.
doc. MUDr. Jan Heller, CSc.
doc. Ing. Monika Šorfová, Ph.D.
Mgr. Pavel Hráský, Ph.D.
MUDr. Simona Majorová

The research project was approved by UK FTVS Ethics Committee under the registration number: 090/2016
Date of approval: 6.4.2016

UK FTVS Ethics Committee reviewed the submitted research project and **found no contradictions** with valid principles, regulations and international guidelines for carrying out research involving human subjects.

The applicant has met the necessary requirements for receiving approval of UK FTVS Ethics Committee.

Stamp of UK FTVS UNIVERZITA KARLOVA v Praze Fakulta telesné výchovy a sportu José Martího 31, 162 52, Praha 6 1

Signature of the Chair of UK FTVS Ethics Committee

6.2 INFORMOVANÝ SOUHLAS

UNIVERZITA KARLOVA V PRAZE
FAKULTA TĚLESNÉ VÝCHOVY A SPORTU
José Martího 31, 162 52 Praha 6-Veleslavín

INFORMOVANÝ SOUHLAS

Vážená paní, vážený pane,

v souladu se Všeobecnou deklarací lidských práv, zákonem č. 101/2000 Sb., o ochraně osobních údajů a o změně některých zákonů, ve znění pozdějších předpisů, Helsinskou deklarací, přijatou 18. Světovým zdravotnickým shromážděním v roce 1964 ve znění pozdějších změn (Fortaleza, Brazílie, 2013) a dalšími obecně závaznými právními předpisy Vás žádám o souhlas s prezentováním a uveřejněním výsledků vyšetření a průběhu terapie prováděné v rámci praxe na ...Oblastní Nemocnice Kladno... kde Vás příslušně kvalifikovaná osoba seznámila s Vaším vyšetřením a následnou terapií. Výsledky Vašeho vyšetření a průběh Vaší terapie bude publikován v rámci bakalářské práce na UK FTVS, s názvem ...ISCHAEMIC CEREBROVASCULAR ACCIDENT (STROKE) IN SUB-ACUTE PHASE

Získané údaje, fotodokumentace, průběh a výsledky terapie budou uveřejněny v bakalářské práci v anonymizované podobě. Osobní data nebudou uvedena a budou uchována v anonymní podobě. V maximální možné míře zabezpečím, aby získaná data nebyla zneužita.

Jméno a příjmení řešitele ...Mimis Kouvaris... Podpis:.....

Jméno a příjmení osoby, která provedla poučení...TOMÁŠ HODLMOSER... Podpis:.....

Prohlašuji a svým níže uvedeným vlastnoručním podpisem potvrzuji, že dobrovolně souhlasím s prezentováním a uveřejněním výsledků vyšetření a průběhu terapie ve výše uvedené bakalářské práci, a že mi osoba, která provedla poučení, osobně vše podrobně vysvětlila, a že jsem měl(a) možnost si řádně a v dostatečném čase zvážit všechny relevantní informace, zeptat se na vše podstatné a že jsem dostal(a) jasné a srozumitelné odpovědi na své dotazy. Byl(a) jsem poučen(a) o právu odmítnout prezentování a uveřejnění výsledků vyšetření a průběhu terapie v bakalářské práci nebo svůj souhlas kdykoli odvolat bez represí, a to písemně zasláním Etické komisi UK FTVS, která bude následně informovat řešitele.

Místo, datum ...18.1.2016...

Jméno a příjmení pacienta [redacted] Podpis pacienta: [redacted]

Jméno a příjmení zákonného zástupce .....

Vztah zákonného zástupce k pacientovi ..... Podpis: .....

6.3 List of Figures

6.4 List of tables:

6.5 List of abbreviations:

ADL-Activities of Daily Living

CVA- Cerebrovascular Accident

MCA- Middle Cerebral Artery

MMSE- Mini Mental Status Examination

TPA-Tissue Plasminogen Activator

BMI – Body Mass Index

ROM – Range Of Motion

MRI- Mangnetic Resonance Imaging

CT-Computed Tomography

PNF- Proprioceptive Neuromascular Facilitation

TENS- Transcutaneous Electrical Nerve Stimulation

FES-Functional Electrical Stimulation

UE – Upper Extremity

LE – Lower extremities